# Explaining the learning decline in PISA 2025 by socioeconomic quartiles through methodological changes

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**Abstract**

PISA 2025 Volume I (OECD 2026a) reports that the socioeconomic gap narrowed between 2022 and 2025 because advantaged students declined most — "*a new phenomenon of affluent students who struggle academically*". However, this pattern is explained by the changes in how the index of economic, social and cultural status (ESCS) was computed in 2022 and 2025, not by changes in students' performance: the home possessions index removed the book-type items most related to achievement in the 2025 edition and replaced them with living conditions items less correlated to learning achievement, thereby changing which students were classified in the top socioeconomic quartile. By computing an alternative harmonized ESCS index that ensures comparability across years, the top–bottom gap in mathematics increases by 1.6 points across 36 OECD systems, instead of the decline of 11 points reported in OECD (2026a). In practice, this reclassification implies that the number of countries with a statistically significant narrowing of the mathematics gap between the top and bottom ESCS quartiles falls from 19 to 1. The published narrowing is also substantially attenuated in science and reading, and this attenuation is robust across specifications. When extended to the 2015–2025 period, we observe that the true ESCS learning gap remained broadly stable, if anything widening slightly over the last decade.

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## 1. Introduction

PISA 2025 recorded the lowest OECD-average performance observed so far in all three core domains, continuing the decline that began around 2012 in reading and accelerated after 2018 in mathematics. Among the findings that Volume I (OECD 2026a) highlights is the distribution of that decline across socioeconomic groups. Between 2022 and 2025, on average across OECD countries, performance declined significantly among socioeconomically advantaged students — by 8 score points in science, 14 in mathematics and 20 in reading — while the change among disadvantaged students was not significant in science and mathematics and amounted to 4 points in reading. The gap between the top and bottom quartiles of the index of Economic, Social and Cultural Status (ESCS) therefore narrowed by 13 points in science, 11 in mathematics and 17 in reading; in mathematics, the gap decreased in 29 countries and economies. The executive summary of OECD (2026a) lists this as a key finding, and so does the Annex on trends over 2018–2025, noting that the largest drops occurred in the most advantaged quartile. Between 2018 and 2025, the socioeconomic gap in reading narrowed in 36 systems and widened in two. It concludes that these results "suggest a new phenomenon wherein a group of students from relatively affluent families, but who struggle academically, are contributing most to the overall decline."

However, Volume 1 of PISA 2025 results does not offer an explanation for this finding. It cautions that a shrinking socioeconomic gap does not necessarily mean a fairer system if it comes from declining performance among advantaged students rather than gains among the disadvantaged. It explores, without concluding, the role of engagement and effort, the rise of hasty responding, the spread of digital devices, and the general erosion of reading. Its investigation of whether the overall decline is genuine — through item-level analyses, response times and test-fatigue indicators — is thorough. It does not examine whether the index used to sort students into socioeconomic quartiles measures the same construct in 2022 and in 2025.

The argument that socioeconomic gradients in PISA are sensitive to how the index is constructed is not new; Avvisati (2020) reviews the measurement of ESCS and argues for a stable operationalization across cycles, and Jerrim and Zieger (2024) find that measurement and procedural error substantially affect estimated gradients. However, the 2022–2025 comparison has not been examined from this perspective.

Family cultural resources and material resources are related but analytically distinct. Evidence from earlier PISA reports shows that books in the home remain associated with reading performance after accounting for parental education, occupation and household possessions (Evans, Kelley, and Sikora 2014). This distinction is relevant especially for the interpretation of HOMEPOS: changing the representation of book-related resources within the index may alter which students are classified as socially advantaged as well as the achievement profiles of those groups, even if the underlying relationships between family resources and achievement remain unchanged.

This paper proposes and tests a simpler hypothesis: that the pattern is only a property of the measurement instrument. ESCS is a composite of three components (parental education, parental occupation and a composite index of home possessions), and two of the three were measured

differently in 2025. The home possessions index was scaled from a battery in which eleven items were removed and twenty added (for each country to pick six of them), and the Technical Report for 2025 does not describe it as linked to any previous cycle. Furthermore, parental education was collected with new questions.

The underlying hypothesis to be tested is that if the items removed were more strongly related to achievement than the items added. The students classified as socioeconomically "advantaged" in 2025 are a different and lower-achieving group than those so classified in 2022, and the top ESCS quartile will appear to decline for that reason alone. We test this by rebuilding each component of the ESCS index and a harmonized comparable ESCS across trends. We do so by holding the item selection fixed across cycles, recomputing the quartiles, and comparing the two sets of results — overall, item by item, system by system, over four cycles.

Three results follow. First, on a fixed item-rule ESCS index that is harmonized across years, the gap does not narrow: the change in the top–bottom gap, averaged across 36 OECD systems, is about +1.6 in mathematics instead of the published -11.2. The decline is spread across quartiles rather than concentrated at the top, and the number of systems with a significant narrowing falls from 19 to 1. Second, the discrepancy is traceable to the items specific to each cycle: the 2022 index gave weight to the book-type items, which are the items most related to achievement over and above parental occupation and education, and the 2025 index to national items that carry no achievement gradient; two thirds of the discrepancy arises in 2022 and one third in 2025. Third, over the period from 2015 to 2025, the harmonized ESCS gap in mathematics widens slowly, with 2025 as the highest value of the decade, and parental education, considered separately, indicates a decline in outcomes concentrated at the bottom rather than at the top.

The rest of the paper is organized as follows. Section 2 describes the data, the construction of ESCS, the changes between the two cycles, and the harmonization. Section 3 presents the results for mathematics: the headline comparison by quartile and decile (3.1), the reclassification of students between indices (3.2), the item-level content of the possessions index (3.3), the decomposition of the discrepancy by cycle and the four-cycle series (3.4), the patterns across education systems (3.5), and the behavior of parental education (3.6). Section 4 sets out the implications and concludes. Annex A gives supplementary tables for mathematics, Annexes B and C replicate the results for science and reading, and Annex D reports the robustness of the composite to its construction.

## 2. Data and method

### *2.1 Data*

We use the PISA 2022 and PISA 2025 student public use files released by the OECD, restricted to the 36 OECD education systems present in both cycles[1]. For the four-cycle analysis of Section 3.4

[1] Countries include Australia, Austria, Belgium, Canada, Chile, Colombia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye, the United Kingdom and the United States. Luxembourg participated only in 2025, and Costa Rica is excluded because the socioeconomic components are not available in the file used

we add the 2015 and 2018 files and keep the 34 systems present in all four cycles. The working sample is 591,399 students for the two-cycle analyses and about 1.08 million student records for the four-cycle series.

The outcomes used are the ten plausible values in each domain. All estimates use the final student weight; standard errors combine the sampling variance from the 80 balanced repeated replication weights with Fay's factor of 0.5 and the imputation variance across plausible values, following the OECD's procedures. Socioeconomic quartiles are of equal weighted size: within each system and cycle, students are sorted by the index and cut into four groups each holding exactly 25% of the student weight, with ties broken at random under a fixed seed, and the cut points are recomputed within each replicate. The common additive link error cancels in within-cycle differences between socioeconomic groups and hence in changes in these gaps across cycles. It does not cancel in changes in individual group means. The reported standard errors and confidence intervals include sampling and plausible-value imputation variance only; intervals for changes in individual group means therefore exclude link error and are conditional on the estimated cross-cycle link. Averages across systems are simple averages, as computed in OECD (2026a).

From the student file we use ESCS and its three published components (HISEI, PAREDINT, and HOMEPOS), the items of the household possessions questions (ST250, ST251, ST254, and ST255 in both cycles; ST256, and ST253 in 2022; and the national items ST250Q08–Q28DA in 2025), the number of books at home, and the plausible values and weights.

### *2.2 Construction of ESCS*

According to the PISA 2022 and PISA 2025 Technical Reports (OECD 2024, 2026b), ESCS is a composite of three indicators chosen to represent the three classical dimensions of socioeconomic status (Sirin 2005): occupation, education and income and wealth. The occupation component, HISEI, is the higher of the two parents' scores on the International Socioeconomic Index of occupational status (ISEI), obtained by coding the students' open-ended descriptions of their parents' jobs to four-digit ISCO-08 and mapping these to ISEI. The education component, PAREDINT (PARED in what follows), converts the highest ISCED (International Standard Classification of Education) level reported for either parent into a number of years of schooling, using a conversion common to all countries since 2018. The income/wealth component, HOMEPOS, is an IRT-scaled index of household possessions: students report whether their home contains each of a list of items and for some items, how many. The responses are scaled with a two-parameter logistic model for the dichotomous items and a generalized partial credit model for the polytomous ones. The resulting weighted likelihood estimates are placed on a scale with mean 0 and standard deviation 1 across equally weighted OECD countries. Since 2022, the composite is built by imputing the missing component, for students missing exactly one of the three, from a regression on the other two estimated within each country on students with all three components, plus a random residual; students missing two or more have no ESCS. Each component, imputed values included, is then standardized across OECD countries with each country contributing approximately equally through senate weights, the arithmetic mean

of the three standardized components is taken, and the result is standardized again. The published quartiles used in OECD (2026a) are national quartiles of this final score.

Two features of the procedure matter for comparisons over time. First, each component is standardized in each cycle, so the metric is re-anchored to the OECD distribution of that cycle: a given value of the index does not carry the same meaning from one cycle to the next unless the earlier scores are recomputed. This is by design, and it is no obstacle for the quartiles used here, which are ranks within a cycle. Nor has it prevented comparison over time in the past, since the OECD recomputed ESCS for 2012, 2015, and 2018 to make it comparable with 2022. Second, such recomputation is only possible if the home possessions index is itself linked across cycles: HOMEPOS is comparable over time only where the items entering it and their parameters are held fixed, as was done in the cycles where it was treated as a trend scale. The parameters of items common to the previous cycle are fixed to their earlier values. This is the condition that the 2025 cycle does not meet. The 2025 Technical Report states that "in contrast to what was done in previous cycles, the ESCS computed for PISA 2025 is not treated as a trend scale", given the "considerable changes to the section in the student questionnaire in terms of how parental education, occupation and home possessions were captured", and, unlike the other scales in the same chapter, it does not describe HOMEPOS as linked to any earlier cycle. Trend analysis across 2025 and earlier cycles therefore requires a new composite construct on a common metric and from a common item set. This is what is done below.

### *2.3 Changes in the instrument between 2022 and 2025*

Two of the three components were measured differently in 2025: household possessions and parental education. Table 1 lists the possession items in each cycle. Sixteen items are common to both: five yes/no items on a room of one's own, a computer for schoolwork, educational software, a phone with internet and internet access; five counts of cars, bathrooms, flush toilets, musical instruments and works of art; five counts of digital devices; and the sixteenth item is the number of books at home.

Eleven international items present in 2022 are absent in 2025: the eight book-type items of ST256, which asked whether the home had religious books, classical literature, contemporary literature, science books, art, music or design books, technical reference books, dictionaries and books to help with schoolwork; the number of cell phones; mopeds; and the count of screen devices, which survives in the 2025 file with about 1% coverage. In addition, each system administered two national possessions items in 2022 (ST250D06 and ST250D07), which entered the 2022 index with country-specific parameters and were also dropped.

Twenty items were entered in 2025 as national options, from which each system selected about six: electric lighting, plumbed water, off-street parking, garbage collection, a stove, a table for meals, a vacuum cleaner, a refrigerator, a sewer connection, air conditioning or heating, a guest room, a quiet place to study, a swimming pool, a security system, a smart TV, a dishwasher, an own tablet, a TV or streaming subscription, domestic workers and a newspaper subscription. Two of the

**Table 1. Household possession items by cycle, with the 16-item common core (2022–2025) and 13-item four-cycle core (2015–2025) in the final two columns.** An asterisk marks desktop and laptop computers, combined into one item in the four-cycle core. Country-specific count items ST251Q08/Q09 are excluded.

| Item | Variable | 2022 | 2025 | Common core (16 items) | Four-cycle core (13 items) |
|---|---|---|---|---|---|
| **Household possessions (yes/no)** | | | | | |
| A room of your own | ST250Q01 | x | x | x | x |
| A computer for schoolwork | ST250Q02 | x | x | x | x |
| Educational software or apps | ST250Q03 | x | x | x | x |
| Your own phone with internet access | ST250Q04 | x | x | x | |
| Internet access at home | ST250Q05 | x | x | x | x |
| **Number of items in the home** | | | | | |
| Cars, vans or trucks | ST251Q01 | x | x | x | x |
| Rooms with a bath or shower | ST251Q03 | x | x | x | x |
| Rooms with a flush toilet | ST251Q04 | x | x | x | |
| Musical instruments | ST251Q06 | x | x | x | x |
| Works of art | ST251Q07 | x | x | x | x |
| **Digital devices in the home** | | | | | |
| Televisions | ST254Q01 | x | x | x | x |
| Desktop computers | ST254Q02 | x | x | x | x* |
| Laptops or notebooks | ST254Q03 | x | x | x | x* |
| Tablets | ST254Q04 | x | x | x | x |
| E-book readers | ST254Q05 | x | x | x | x |
| **Books** | | | | | |
| Number of books at home | ST255Q01 | x | x | x | x |
| **Items used only in 2022** | | | | | |
| Religious books | ST256Q01 | x | | | |
| Classical literature | ST256Q02 | x | | | |
| Contemporary literature | ST256Q03 | x | | | |
| Science books | ST256Q06 | x | | | |
| Art, music or design books | ST256Q07 | x | | | |
| Technical reference books | ST256Q08 | x | | | |
| Dictionaries | ST256Q09 | x | | | |
| Books to help with schoolwork | ST256Q10 | x | | | |
| Cell phones (number) | ST254Q06 | x | | | |
| Mopeds or motorcycles | ST251Q02 | x | | | |
| Screen devices (number) | ST253Q01 | x | (1.2%) | | |
| National items 2022 (two per system) | ST250D06, ST250D07 | x | | | |
| **Items used only in 2025 (national selection, about six per system)** | | | | | |
| Electric lighting | ST250Q08DA | | x | | |
| Plumbed water | ST250Q09DA | | x | | |
| Off-street parking | ST250Q10DA | | x | | |
| Garbage collection | ST250Q11DA | | x | | |
| Stove or burner | ST250Q12DA | | x | | |
| Table for meals | ST250Q13DA | | x | | |
| Vacuum cleaner | ST250Q14DA | | x | | |
| Refrigerator | ST250Q15DA | | x | | |
| Sewer connection | ST250Q16DA | | x | | |
| Air conditioning or heating | ST250Q18DA | | x | | |
| Guest room | ST250Q19DA | | x | | |
| Quiet place to study | ST250Q20DA | | x | | |
| Swimming pool or jacuzzi | ST250Q21DA | | x | | |
| Security system | ST250Q22DA | | x | | |
| Smart TV | ST250Q23DA | | x | | |
| Dishwasher | ST250Q24DA | | x | | |
| Own tablet | ST250Q25DA | | x | | |
| TV or streaming subscription | ST250Q26DA | | x | | |
| Domestic workers | ST250Q27DA | | x | | |
| Newspaper subscription | ST250Q28DA | | x | | |

twenty were not administered in any OECD system. The 2025 possessions index therefore rests on a different and system-specific item mix.

The measurement of parental education also changed. In 2022 students answered separate questions about their mother's and father's highest level of schooling and post-secondary qualifications (ST005–ST008), which were coded to ISCED categories running from "less than ISCED 1" through ISCED 1, 2, 3.3, 3.4, 4, 5, 6, 7 and 8. In 2025 the questions were replaced by ST405 and ST410, framed around "parent or guardian 1" and "parent or guardian 2", and the category set was rewritten: the lowest category is "does not have any of the listed qualifications", followed directly by ISCED 2, so the primary-education category disappears. The derived years-of-schooling variable accordingly takes the values 3, 6, 9, 12, 14.5, and 16 in 2022 and 6, 9, 12, 14 and 16 in 2025. Weighted coverage of parental education falls from 94.7% to 80.8%. The source items are not released in the 2025 public file — only the derived HISCED and PAREDINT are — so the effect of the new wording cannot be studied at the item level. The OECD field-trial experiment (Avvisati and Wuyts 2024) found fewer reported tertiary qualifications under a guardian-focused format that included an explicit "I don't know" option, although the effect of that option could not be isolated from other changes in question format, and warned that such an option would likely disrupt trends; the 2025 main survey questionnaire retained the guardian-focused format but did not include an explicit "I don't know" option. Parental occupation was also collected with new questions (ST408, ST491, ST492) but the ISEI scale is identical in both cycles (11.01 to 88.96) and coverage falls from 89.7% to 76.0%.

### *2.4 Harmonization*

The concept of index harmonization implies that the two cycles are pooled into a single sample. Each component is measured with the same items and the same rule for every student in that sample, and any scaling parameters are estimated across the pool rather than separately by cycle. Under this definition a change in the index between cycles can only reflect a change in what students report, not a change in the questions or in the scaling. The three components and the composite are built as follows.

- **HISEI.** The ISEI scale is identical in both cycles, so harmonization is a standardization over the pooled sample. Because quartiles are ranks within country and cycle, this leaves the published HISEI quartiles unchanged; the component enters the harmonized composite on a common metric.
- **PARED.** The OECD publishes PAREDINT with a different set of values in each cycle — {3, 6, 9, 12, 14.5, 16} in 2022 and {6, 9, 12, 14, 16} in 2025, because the new questions have no below-primary category and place short-cycle tertiary at 14 rather than 14.5 years — and provides no bridge between them. We therefore map the 2022 value of 3 to 6 and 14.5 to 14 so that both cycles share the value set {6, 9, 12, 14, 16} and standardize the result over the pool. This is our decision, and it is close to innocuous: 14.5 and 14 occupy the same position in their cycle's

ladder (nothing lies between 12 and 16 in either), so the recode changes the cardinal value used in the standardization but not any student's rank; only the merge of 3 into 6 reorders anything, and it affects 0.9% of the 2022 sample. After the recode the two cycles have the same five categories with comparable shares (3.7, 8.3, 26.8, 10.7, and 50.5% in 2022; 3.6, 10.5, 29.9, 9.1, and 46.8% in 2025). Because half of the students are at the maximum of 16 years, the upper quartiles of PARED are partly a random split of the same category, and where parental education is read on its own we use fixed categories (tertiary versus twelve years or fewer) rather than quartiles.

- **HOMEPOS.** A single-factor graded response model — the polytomous item response model in which each item has a discrimination parameter and K-1 thresholds, where K is the number of response categories — is estimated on the sixteen common items with the pooled 2022 and 2025 sample, each country-by-cycle cell weighted equally. This is a concurrent calibration: one set of item parameters serves both cycles, which is the restriction that the OECD applies to its trend scales and did not apply to HOMEPOS in 2025. Students are then scored with the expected a posteriori (EAP) estimate, that is, the mean of the posterior distribution of the latent possessions score given the student's responses and a standard normal prior; students with fewer than ten of the sixteen items are left missing. The harmonized HOMEPOS score correlates 0.906 with the published HOMEPOS in 2022 and 0.955 in 2025.
- **Composite.** We construct a harmonized ESCS using OECD's own rule: the equal-weighted mean of the three standardized components, with a single missing component imputed by regression on the other two within country and cycle, and no index for students missing two or more. The harmonized and the published indices therefore should differ only in the components that enter them, not in how those are combined; the two correlate 0.971.

The analysis is expanded across the 2015, 2018, 2022, and 2025 editions. For the 2015–2025 series the same procedure is applied with the thirteen possessions items whose concept exists in every cycle: a room of one's own, a computer, educational software, internet access, works of art, musical instruments, cars, bathrooms, televisions, tablets, e-book readers, computers, and books. They are recoded to common response categories where formats differ, one graded response model for the four cycles, and parental education placed on the common scale in every cycle (in 2015 the file carries country-specific years of schooling, so PAREDINT is rebuilt from HISCED with the mapping used since 2018). The four-cycle harmonized HOMEPOS score correlates 0.90, 0.90, 0.88, and 0.90 with the published HOMEPOS in 2015, 2018, 2022, and 2025 (0.87 to 0.89 on average within systems), and the four-cycle harmonized ESCS correlates 0.96 to 0.97 with the published ESCS in each cycle. The 34 systems are the 36 of the two-cycle analysis minus Colombia and Lithuania, which were not OECD members in the 2015 cycle.

The share of students without a valid ESCS rises from 3.8% to 8.1% on average across the 36 OECD systems (simple average of weighted shares), and those students score 427 score points in 2022 and 394 in 2025 in mathematics, a fall of 33 points against 3 to 14 for the quartiles with valid data. This is a substantive issue, but it is not the channel behind the top-quartile result. Restricting both cycles to students with valid values on all three components, the change in the top–bottom gap

under the published ESCS is −11.7 in mathematics, against −11.2 in the full samples. Conditioning on complete response does not remove the decline of the published top quartile; changing the possessions instrument does.

## 3. Results

This section reports the results for mathematics, with science and reading in Annexes B and C. Section 3.1 establishes that the published narrowing of the socioeconomic gap depends on the ESCS not being comparable across cycles; Sections 3.2 to 3.4 trace the discrepancy to its source: the students reclassified between indices, the content of each home possessions item, and the cycle in which the published index departs from the common core, together with the four-cycle series. Section 3.5 examines the disagreement between indices across education systems and Section 3.6 the behavior of parental education.

### *3.1 Comparison of published and harmonized ESCS*

Table 2 gives, for each index, the change between 2022 and 2025 in the mean score of each equal-weight quartile and in the gap between the top and bottom quartiles. “Published” is the index as released by the OECD, the basis of the Volume I results; “harmonized” is the version of Section 2.4. Three features stand out. First, under the published ESCS, the change is concentrated entirely in the top quartile: the bottom three quartiles change by −2.8, −3.9, and −2.6 score points while the top quartile changes by −14.0. Second, under the harmonized ESCS, the profile is almost flat: −7.7, −5.2, −4.0, and −6.2, with a gap change of +1.6 points (+2.0 in science and −2.3 in reading, see Annexes B and C). Third, each component is compared with itself, that is, the change of its quartile means under the published version against the change under the harmonized version of the same component. For household possessions the two versions diverge: under the published HOMEPOS the bottom quartile rises +7.2 and the top quartile falls −27.8, while under the harmonized HOMEPOS all quartiles decline slightly and almost uniformly, from −6.5 to −10.4. Parental occupation (HISEI), which needs no harmonization, is flat across quartiles; parental education (PARED), on its common scale, moves in the opposite direction, with the bottom quartile falling −11.1 and the top quartile rising +2.1.

Figure 1 presents these results graphically. Under the published HOMEPOS, the quartiles diverge sharply; under the harmonized HOMEPOS, they decline almost uniformly, and the published ESCS shows a milder version of the same pattern. A genuine narrowing of socioeconomic gaps would appear whichever items were used to measure possessions; here it appears only when the items change between cycles.

**Table 2. Change 2022–2025 in mean score in mathematics by equal-weight quartile and in the Q4 − Q1 gap, by index.** Simple average of 36 OECD systems. The last column gives the standard error (s.e.) of the change in the Q4 − Q1 gap, combining sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values. Quartiles are recomputed within system, cycle and BRR replicate. HISEI, PARED and books use the common metrics of Section 2.4.

| Index | Version | Q1 | Q2 | Q3 | Q4 | Q4 − Q1 | (s.e.) |
|---|---|---|---|---|---|---|---|
| **ESCS** | **Published** | **−2.8** | **−3.9** | **−2.6** | **−14.0** | **−11.2** | **1.19** |
| | **Harmonized** | **−7.7** | **−5.2** | **−4.0** | **−6.2** | **+1.6** | **1.21** |
| HOMEPOS | Published | +7.2 | −2.1 | −12.4 | −27.8 | −35.0 | 1.14 |
| | Harmonized | −6.5 | −8.6 | −9.3 | −10.4 | −4.0 | 1.13 |
| HISEI | Common metric | −4.8 | −3.4 | −3.0 | −6.4 | −1.6 | 1.14 |
| PARED | Common metric | −11.1 | −7.8 | +0.3 | +2.1 | +13.2 | 0.98 |
| Books at home | Common metric | −7.0 | −9.1 | −8.9 | −10.1 | −3.1 | 1.17 |

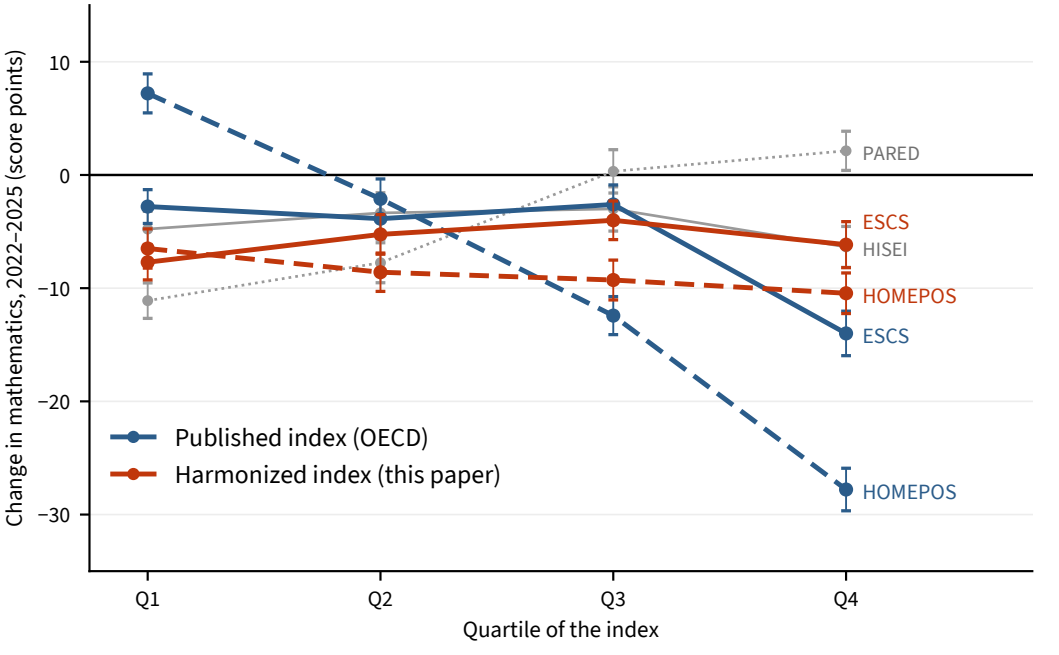


**Figure 1. Average change in mathematics scores across OECD-35 systemss (2022 - 2025), by quartile of published and harmonized indices**. Colour identifies the version: blue denotes the published index (OECD) and orange the harmonized index (this paper). Solid lines show ESCS and dashed lines HOMEPOS. The harmonized HOMEPOS is a graded response model calibrated once on both cycles with the 16 common items, whereas the published index changed items between cycles; the harmonized ESCS combines the three harmonized components with the OECD's rule for the composite. Grey lines show parental occupation (HISEI, solid) and parental education (PARED, dotted) on their harmonized metric, which have no published counterpart. Quartiles hold 25% of the student weight each and are computed within each system and cycle; values are simple averages of 36 OECD systems. Vertical error bars show 95% confidence intervals for each quartile's change in mean score. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

If we go deeper and split the distribution into deciles rather than quartiles (Figure 2), the discontinuity becomes sharper still. Under the official index the change is essentially flat from D1 to D8, and the entire gradient is produced by the last two deciles, which fall to −10.3 and −23.4. The harmonized ESCS index shows no such break: every decile declines within a narrower band, ending at −7.9. The change in the top-to-bottom decile gap is therefore around 23 points under the official index and barely 1 under the harmonized one.

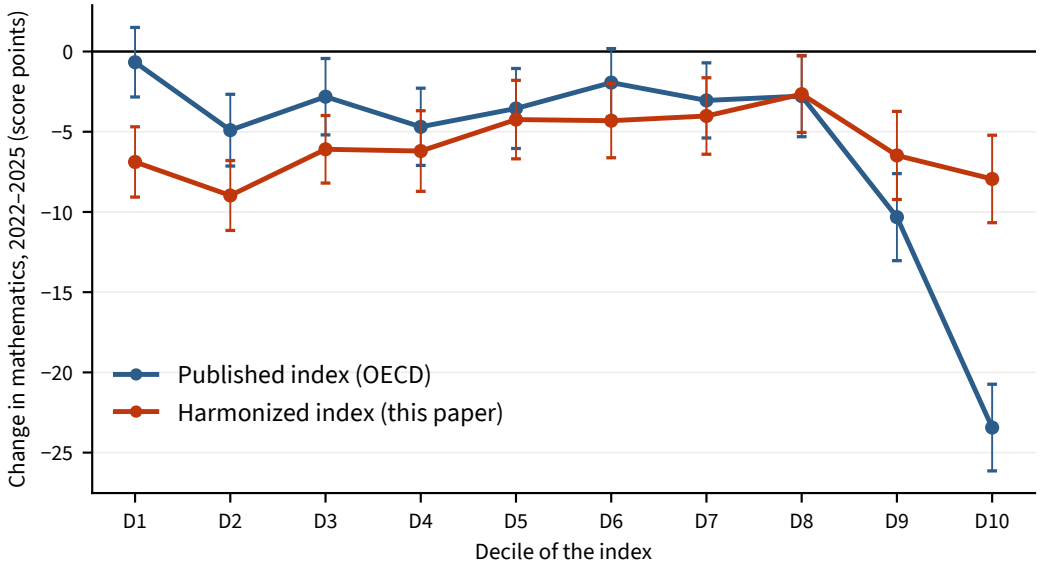


**Figure 2. Change 2022–2025 in mean mathematics score by decile of ESCS: published versus harmonized index.** Orange lines show harmonized ESCS (this paper), which rescales the household possessions component on the 16 items present in both cycles with a single joint calibration and follows the OECD's rule for the composite; blue lines show ESCS as published by the OECD, which does not use the same questions in 2022 and in 2025, so that its change between cycles mixes a change in students with a change of instrument. Deciles are computed within each system and cycle (D1, lowest ESCS; D10, highest); values are simple averages of 36 OECD systems. Vertical error bars show 95% confidence intervals for each decile's change in mean score. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

### *3.2 Reclassification of students between indices*

If the published top quartile of HOMEPOS is a different group of students in 2025 than in 2022, then the proposed reclassification with a harmonized index should reveal it. Within each system and cycle, students are assigned to HOMEPOS quartiles twice, by the published and by the harmonized HOMEPOS index; the assignment depends solely on their questionnaire responses, not on the achievement domain. As Table 3 shows, in 2022 a third of students change quartile (34.0%) and 78.5% of the published top quartile remains in the harmonized top quartile, with a within-system correlation between the two indices of 0.904; in 2025 the corresponding figures are 25.4% and

84.0% and 0.946, and the bottom quartile behaves much like the top in both cycles. Agreement is therefore lower in 2022 than in 2025: it is the earlier classification that is more sensitive to the choice of items. In neither cycle, however, do the two indices place the same students in the same quartile.

**Table 3. Agreement between quartiles of the published and the harmonized HOMEPOS, 36 OECD systems**

| | 2022 | 2025 |
|---|---|---|
| Students who change quartile | 34.0% | 25.4% |
| Published Q4, still in harmonized Q4 | 78.5% | 84.0% |
| Published Q1, still in harmonized Q1 | 77.8% | 84.3% |
| Correlation between the two indices (within system) | 0.904 | 0.946 |

The students who are reclassified have a distinct profile, and it reverses between cycles (Table 4). In 2022, students dropped from the top quartile by the harmonized index outscore those who remain in it — 520 against 508 in mathematics — and report more book types (7.2 against 6.9) despite lower parental occupational status (60.7 against 64.3). The bottom quartile tells the same story from the other end: students whom the harmonized index moves into it score 464, well above the 418 of those in the bottom quartile under both indices, and report 6.3 book types against 3.7. The published 2022 index was pulling book-rich students up and keeping them out of the bottom quartile, whatever their material conditions were. In 2025 the sign flips: students from the published (not harmonized) top quartile now score below those who remain in both specifications (464 against 489), with lower occupational status (57.3 against 63.4), fewer books and more “yes” answers on the country-specific items. Those the harmonized index promotes into the top quartile (who did not appear using the published OECD) score 507. The published index thus over-selected the top quartile on cultural capital in 2022 and on nationally chosen possessions in 2025—the first tracks achievement, the second does not. This composition effect points in the same direction as the pattern in Figure 1: the published top quartile appears to contain a surplus of high scorers in 2022 and of low scorers in 2025, so part of the decline in its mean may reflect how the quartile was defined rather than a change in student performance.

**Table 4. Profile of students classified differently by the published and the harmonized HOMEPOS, mathematics score (weighted means, 36 OECD systems).** Scores are the mean of the ten plausible values, used descriptively. The number of books at home is coded from 1 (no books) to 7 (more than 500); book types is the count of the eight ST256 categories present. National items is the count of ST250Q08–Q28DA answered "yes", out of about 5.6 administered per system.

| | | Top quartile (Q4) | | | Bottom quartile (Q1) | | |
|---|---|---|---|---|---|---|---|
| | Cycle | Both indices | Published only | Harmonized only | Both indices | Published only | Harmonized only |
| % of students | 2022 | 19.7 | 5.3 | 5.3 | 19.5 | 5.5 | 5.5 |
| | 2025 | 21.4 | 3.6 | 3.6 | 21.5 | 3.6 | 3.6 |
| Mathematics score | 2022 | 508 | 520 | 471 | 418 | 430 | 464 |
| | 2025 | 489 | 464 | 507 | 421 | 460 | 431 |
| HISEI | 2022 | 64.3 | 60.7 | 56.4 | 38.2 | 44.5 | 46.1 |
| | 2025 | 63.4 | 57.3 | 59.8 | 40.4 | 45.7 | 45.0 |
| PARED (years) | 2022 | 15.1 | 14.8 | 14.5 | 12.3 | 13.1 | 13.3 |
| | 2025 | 14.8 | 14.2 | 14.4 | 12.1 | 13.0 | 12.9 |
| Books at home (1–7) | 2022 | 4.87 | 5.06 | 3.71 | 2.58 | 2.76 | 3.69 |
| | 2025 | 4.60 | 4.10 | 4.56 | 2.80 | 3.51 | 3.10 |
| Book types (0–8) | 2022 | 6.90 | 7.17 | 4.76 | 3.70 | 2.91 | 6.33 |
| National items "yes" | 2025 | 4.32 | 4.50 | 2.94 | 2.60 | 2.12 | 3.80 |

### *3.3 Cultural capital and living conditions: analysis by item*

The previous sections attribute the discrepancy to the items specific to each cycle, but those items are not equally related to achievement: within systems and averaged across the 36 OECD systems, the eleven items dropped in 2025 correlate 0.201 with mathematics score, the sixteen common items 0.122, and the eighteen national items added in 2025 only 0.052, with six of them correlating negatively (Table 5). This is what produces the findings above.

Parental occupation and education are collected independently of household possession items, so they provide a second criterion for what an item measures, one that does not involve test scores. On that criterion the added items are also the weaker ones: 0.092 with occupation and 0.089 with education, against 0.150 and 0.128 for the common items. The dropped items go the other way — their relation to occupation is barely above the common core set of items (0.180 against 0.150) while their relation to achievement net of occupation and education is twice as high (0.149 against 0.073), the pattern the OECD describes for the book-type items, which capture cultural capital and are partly endogenous to school success and learning outcomes.

The same holds at the level of the index. If computing the residual of the published HOMEPOS on the sixteen common items, the 2022 residual correlates +0.59 with the number of book types and +0.16 with mathematics, while the 2025 residual correlates +0.64 with the number of national items answered "yes" and $-0.06$ with mathematics. What the published index adds beyond the common core is achievement-related in 2022 and achievement-unrelated in 2025.

Finally, it is worth mentioning an important caution. The common core still contains the number

of books at home, itself a cultural-capital item and the most achievement-related of the sixteen, so the harmonized index is not a pure living-conditions measure. If the aim of the 2025 redesign was a living-conditions construct — the same items feed the new deprivation indicator of Volume I — then the 2025 set is closer to it, and that aim is legitimate. The problem is the comparison across cycles, not the direction of the redesign.

**Table 5. Within-system correlations of possessions items with mathematics achievement, parental occupation (HISEI) and parental education (PARED), by item group, averaged across 36 OECD systems**. Partial r is the correlation with achievement net of HISEI and PARED. The country-specific 2022 items ST250D06 and ST250D07 are excluded.

| Item group | r score | r HISEI | r PARED | partial r |
|---|---|---|---|---|
| Dropped in 2025 (11 items, measured in 2022) | 0.201 | 0.180 | 0.155 | 0.149 |
| Common to both cycles (16 items), 2022 | 0.122 | 0.150 | 0.128 | 0.073 |
| Common to both cycles (16 items), 2025 | 0.108 | 0.143 | 0.132 | 0.056 |
| New in 2025, national selection (18 items with data) | 0.052 | 0.092 | 0.089 | 0.015 |

### *3.4 Decomposition of the discrepancy by cycle, and the four-cycle series*

In levels, the published gap between the top and bottom HOMEPOS quartiles in mathematics (simple average of 36 OECD systems) is 89.5 score points in 2022 and 54.6 in 2025; the harmonized gap is 69.3 and 65.3. The published index is therefore 20.2 points above the harmonized one in 2022 and 10.7 points below it in 2025. Two thirds of the discrepancy arises in 2022 and one third in 2025: the published 2022 index overstates the possessions gradient relative to the fixed core, and the 2025 index understates it, in each case because of the items specific to that cycle. We do not claim that the harmonized core is the "correct" gradient, but that the published change between cycles cannot be interpreted when the two endpoints depart from a common rule in opposite directions.

Figure 3 extends the comparison to four cycles from 2015 to 2025, for the 34 OECD systems present in all four. The two families of index trace different shapes. On the published indices the gap is close to flat from 2015 to 2018, rises sharply in 2022, and falls in 2025 to its 2015 level for ESCS and below 2015 levels for HOMEPOS; the published possessions series reproduces Table I.B1.2b.38 to within half a score point. On the harmonized indices, built with the thirteen items common to all four cycles, the 2022 rise is much smaller. The harmonized ESCS gap in mathematics continues to widen in 2025, whereas the harmonized HOMEPOS gap falls from 69.4 to 66.2 points. The full series by index and cycle is in Table A.1 in Annex A.

Two conclusions follow. The 2022 rise is partly genuine —the harmonized HOMEPOS gap also rises in 2022— but much smaller than the published one, and it does not reverse in 2025. And on a rule held fixed across the four cycles, the socioeconomic gap in 2025 is the widest of the decade rather than equal to or below its 2015 value: the harmonized ESCS gap is 6.5 points wider in 2025 than in 2015 in mathematics.

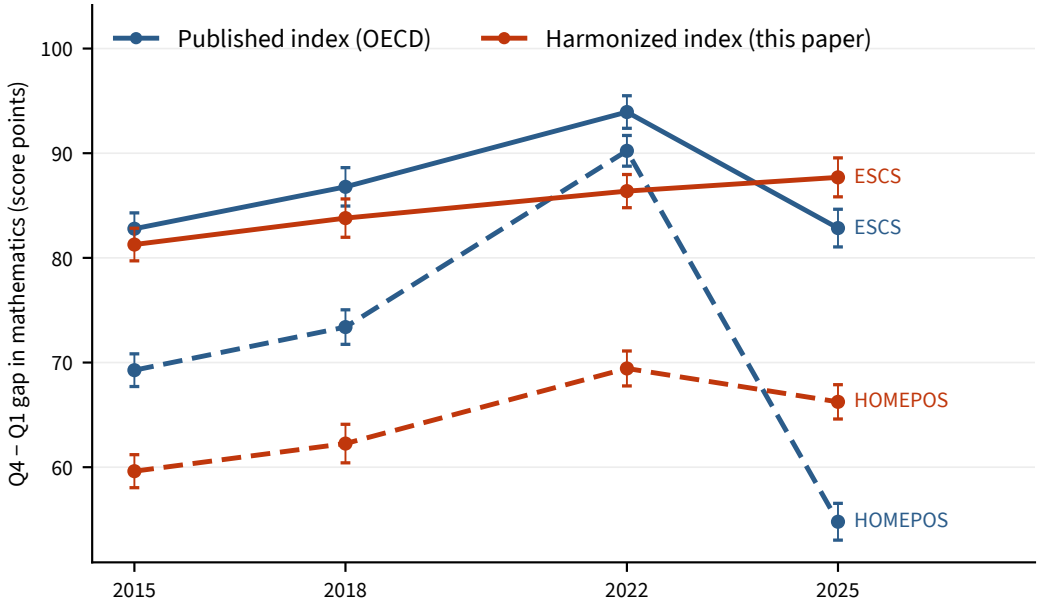


**Figure 3. Level of the socioeconomic gap in mathematics, 2015–2025: published versus harmonized indices.** Difference in mean mathematics score between the top and bottom quartiles (Q4 − Q1) of ESCS (solid lines) and of HOMEPOS (dashed lines). Orange denotes the harmonized four-cycle index (this paper), which uses the 13 possessions items whose concept exists in every cycle with one calibration for the four cycles, parental education mapped to a common scale, and the OECD's rule for the composite; blue denotes the index as published by the OECD. Quartiles hold 25% of the student weight each and are computed within each system and cycle; values are simple averages of the 34 OECD systems present in all four cycles. Vertical error bars show 95% confidence intervals for each estimated Q4 − Q1 gap. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

### *3.5 Results across education systems*

A simple average across 36 systems can hide a good deal of heterogeneity, so it is worth checking whether the result holds system by system. Figure 4 shows the change by ESCS quartile in each of the 36 systems in mathematics, under the published and the harmonized index, and Table A.4 gives the change in the top–bottom gap by system for every index. The result holds everywhere: the published top quartile falls further than the harmonized one in all 36 systems, by 7.8 score points on average and by between 1.8 in Mexico and 17.4 in Slovenia. In several systems — Korea, Iceland, Japan, Denmark, Finland and Italy — the harmonized profile is flat or even slopes in the opposite direction. Under the published ESCS, the change in the top–bottom gap is negative in 31 of 36 systems in mathematics, and significant at 5% in 19; under the harmonized ESCS, it is negative in 17 and significant at 5% in one (Israel), while it widens significantly in two (Greece and Turkey).

If the discrepancy between published and harmonized results comes from the book-type items, it should be larger where cultural capital carries more weight (in richer, higher-scoring, and higher-ESCS systems) and smaller in middle-income systems where material items still discriminate. Table A.6 correlates, across the 36 systems, the mismatch between the published and the harmonized change in the top–bottom gap with the system's mean ESCS in 2022, its mean score in 2022, and log GDP per capita (PPP, 2022). The mismatch is negative — the published index narrows more than the harmonized one — and more so where mean ESCS and mean score are higher: the correlations are $-0.46$ with mean ESCS and $-0.37$ with mean score in mathematics ($-0.58$ and $-0.37$ in science, $-0.51$ and $-0.26$ in reading). The relation with income is weaker and, with 36 systems, not statistically significant in mathematics ($-0.26$) or reading ($-0.31$), although it is in science ($-0.40$). The harmonized change itself is essentially unrelated to income in any domain. The pattern is therefore carried by the socioeconomic and achievement level of the system rather than by income as such.

The system-level detail in Table A.4 illustrates the pattern. Spain has one of the largest reversals: the published ESCS gap narrows by 13.7 score points in mathematics and the harmonized one does not change (0.0), because the published top quartile falls 24 points and the harmonized one 15 while both bottom quartiles fall 10 to 15. In Italy the gap narrows by 6 on the published index and widens by 5 on the harmonized, with the lower quartiles declining more than the upper ones. In the United States the change reverses sign, from $-9$ to +4. Mexico has the smallest mismatch of all (4 points) and Colombia one of the smallest (7 points), consistent with the interpretation that material items still carry a gradient in the two middle-income systems and the redesign changed the ranking less. Slovenia, Israel, Japan, Slovakia and Denmark have the largest mismatches, between 17 and 23 points.

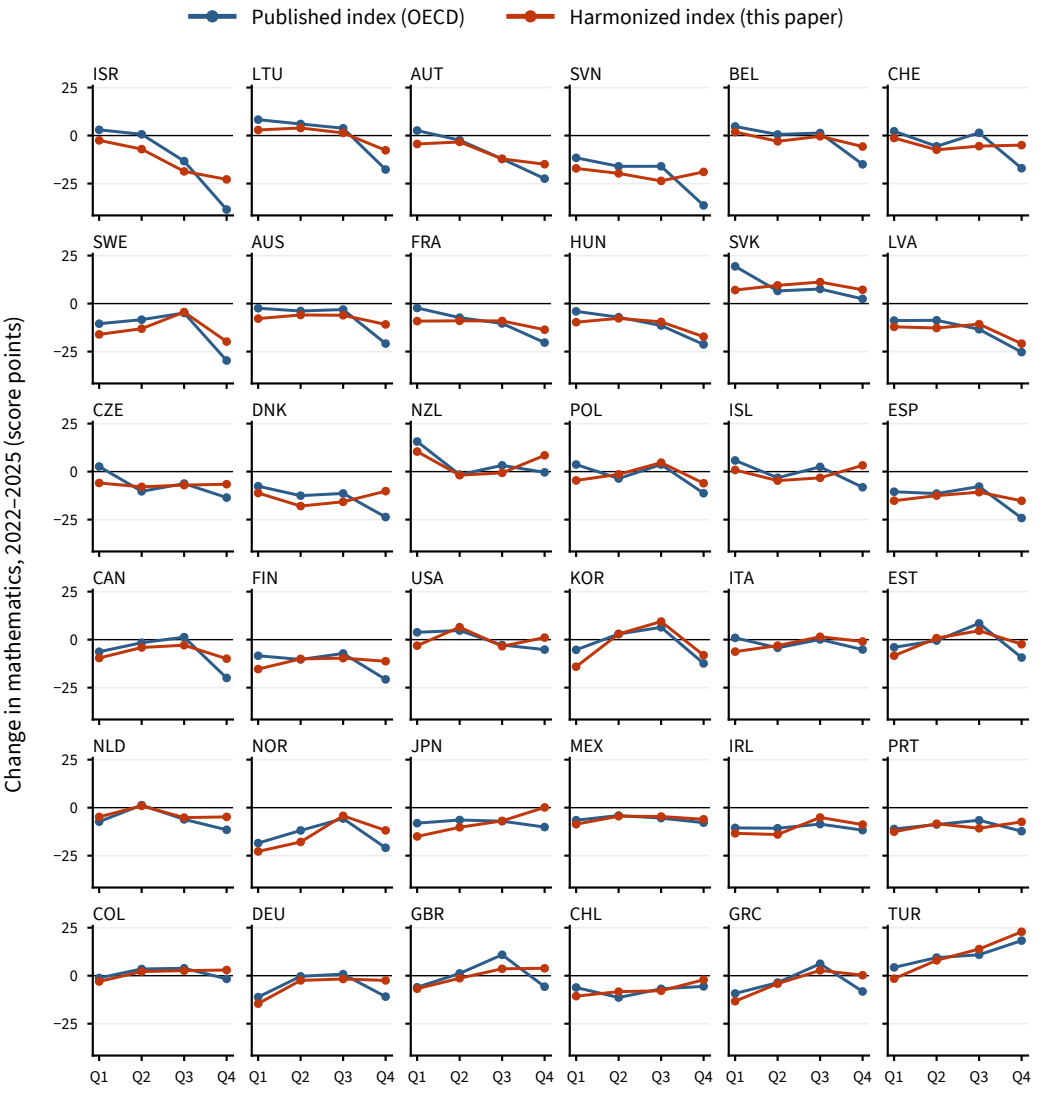


**Figure 4. Change 2022–2025 in mean mathematics score by ESCS quartile, by system.** Each panel is one education system, identified by its three-letter code; panels are ordered by the change in the Q4 − Q1 gap under the published ESCS, from the largest narrowing (top left) to the largest widening (bottom right). Orange lines show harmonized ESCS (this paper), which rescales the household possessions component on the 16 items present in both cycles with a single joint calibration and follows the OECD's rule for the composite; blue lines show ESCS as published by the OECD. Points are the change in the mean score of each equal-weight quartile, computed within system and cycle; the axes are shared across panels. Standard errors of the change in the gap by system are given in Table A.4.

### *3.6 The role of changes in the parental education variable*

Section 2.3 described what changed in the measurement of parental education: new questions framed around guardians rather than mother and father, a rewritten category set without a primary-education level, a fall in coverage of seven percentage points (from 95.1% to 87.6% of students, simple average of the 36 systems), and source items that are not released. Three consequences are visible in the data.

First, the composition of respondents shifts. Among students with a valid value, the share whose parents hold tertiary qualifications (16 years on the common scale) falls from 55.1% to 51.6% (simple average of systems; Table 7), and the harmonized PARED mean falls by 0.1 standard deviations — the first decline in the series, in the cycle in which HISEI rises most, and against the secular rise in tertiary attainment documented by the OECD.

Second, the non-response is linked to other non-response patterns: students do not omit the education question in isolation; rather, a larger group of students in 2025 leaves the whole socioeconomic block unanswered. Among students with a valid HISEI, only 3 to 7% lack PARED in 2025 (6.8% of those with HISEI below 35, 2.8% of those above 65); most of the students without PARED also lack HISEI, and those without PARED have a mean HISEI of 40–44 against 51–53 for the rest. Missing values are concentrated at the bottom of the occupational distribution.

Third, the within-system correlation of parental education with the other components (average of 36 OECD systems) does not fall, but rises slightly with occupation and more so with achievement (Table 6). The component that decouples is the published HOMEPOS index: its correlation with HISEI falls from 0.40 to 0.34 and with achievement from 0.39 to 0.23 in mathematics, while the harmonized HOMEPOS holds more closely at 0.37/0.35 and 0.30/0.28.

**Table 6. Within-system correlations between the components of ESCS and with achievement, published and harmonized versions, mathematics, average of 36 OECD systems.** Achievement is the mean of the ten plausible values. Published indices are the OECD versions; harmonized indices follow Section 2.4.

| | Pub. 2022 | Pub. 2025 | Harm. 2022 | Harm. 2025 |
|---|---|---|---|---|
| HISEI – PARED | 0.441 | 0.479 | 0.451 | 0.479 |
| HISEI – HOMEPOS | 0.399 | 0.339 | 0.366 | 0.352 |
| PARED – HOMEPOS | 0.333 | 0.322 | 0.311 | 0.330 |
| HISEI – achievement | 0.336 | 0.330 | 0.336 | 0.330 |
| PARED – achievement | 0.236 | 0.298 | 0.238 | 0.298 |
| HOMEPOS – achievement | 0.389 | 0.230 | 0.304 | 0.280 |

Considered separately, parental education moves the learning gap in the opposite direction from the headline result from OECD (2026a). Table 7 gives the mean score of groups defined by the same fixed thresholds in both cycles. Students whose parents hold tertiary qualifications did not decline in mathematics (+2.0 score points) while those whose parents have twelve years of schooling or fewer declined by 8.2. The gap in achievement between these two groups therefore widens in both domains for different reasons, and this is one of the possible reasons explaining the

slow widening of the point estimate of the socioeconomic gap since 2022, as observed in 3.

**Table 7. Mean score of groups defined by fixed thresholds in both cycles, mathematics, simple average of 36 OECD systems; share of students in each group.** Shares are calculated among students with a valid value of the grouping variable. Mean scores are accompanied by BRR standard errors (s.e.).

| Fixed group (same threshold in both cycles) | % 2022 | % 2025 | 2022 | 2025 | Change | (s.e.) |
|---|---|---|---|---|---|---|
| Parents with tertiary education (16 years) | 55.1 | 51.6 | 494 | 496 | +2.0 | 0.79 |
| Parents with 12 years or fewer | 33.6 | 38.7 | 451 | 443 | −8.2 | 0.67 |
| HISEI 60 or above | 45.4 | 48.2 | 508 | 502 | −6.4 | 0.78 |
| HISEI below 35 | 30.0 | 27.0 | 442 | 436 | −5.9 | 0.71 |
| More than 100 books | 34.2 | 33.5 | 513 | 503 | −9.7 | 0.85 |
| 25 books or fewer | 36.5 | 37.7 | 433 | 427 | −6.2 | 0.72 |

## 4. Implications and conclusions

This paper has examined one of the key findings of Volume I of PISA 2025: that the decline in student performance between 2022 and 2025 was concentrated among students in the top quartile of the index of economic, social and cultural status so that the socioeconomic gap narrowed and that this reflects a new phenomenon of affluent students who struggle academically. Volume I discusses possible reasons — engagement, effort, the spread of digital devices — without providing evidence or conclusion in this respect.

The results indicate that the published pattern is mainly a consequence of changes in the construction of the Index of Economic, Social and Cultural Status (ESCS) between the two cycles rather than of a change in students. Two of the three components were measured differently in 2025: on the one hand, the household possessions (HOMEPOS) component lost the eight book-type items, which are the items most related to achievement over and above parental occupation and education, and gained twenty nationally selected items on living conditions that are either near-universal in OECD systems or unrelated to achievement. On the other hand, parental education was collected with new guardian-focused questions and a rewritten category set, with coverage falling by seven percentage points on average across systems.

For these reasons the PISA 2025 Technical Report does not treat the 2025 ESCS as a trend scale, yet Volume I reports a trend on it. When the three components are placed on a common and fully comparable rule across cycles, the pattern disappears: in mathematics the top–bottom gap (simple average of 36 OECD systems) changes by +1.6 score points instead of −11.2. The decline is spread across socioeconomic quartiles rather than concentrated at the top. In particular, the number of systems with a statistically significant narrowing falls from 19 to 1, and over the 2015–2025 period, the harmonized ESCS gap in mathematics has widened slowly rather than narrowing (partly because the gap widened, rather than narrowed, through the parental education index). The discrepancy decomposes into two parts: two-thirds arise in 2022, whose index gave weight to the book-type items, and one-third in 2025, whose national items rank students without an

achievement gradient. From a comparative perspective, the mismatch between the two indices is larger in richer, higher-scoring, and higher-ESCS systems and smallest in Mexico and Colombia, the two middle-income systems, as the cultural-capital interpretation predicts.

Two implications follow. First, the "new phenomenon" of affluent students who struggle academically is the mechanical consequence of an index that in 2025 placed students in the top quartile based on items such as a swimming pool, a security system, a guest room or domestic workers, which are weakly related to learning, and no longer owing to the types of books at home, which the 2022 index used and which are strongly related to learning. The declines observed in 2025 are spread across socioeconomic groups; in fact, these declines are larger at the bottom when decomposed by parental education. Whatever their causes, they affect all groups, and the search for causes should not start from a premise that isolates the most socially advantaged students.

Second, at the level of measurement, the episode illustrates a risk that the OECD's methodological work had identified. Avvisati and Wuyts (2024) noted that book and device items relate less stably to affluence over time than basic-necessity items, that the possessions scale relied on data-driven item selection without a theoretical framework and recommended anchoring trend scaling on a restricted set of trend items chosen by expert consensus, with the remaining items used only within cycle. The 2025 redesign of the home possessions item battery had a legitimate purpose — the new deprivation indicator of Volume I is built from it — but its items were used to make trend comparisons, and Volume I then reported a trend on an index that is not comparable across years.

These results do not bear on the overall decline in performance, which the item-level evidence in Volume I supports. The concern is confined to the attribution of that decline across socioeconomic groups—and that attribution, as published, should not be relied upon. Under the harmonized ESCS, the large published narrowing between 2022 and 2025 is substantially attenuated in all three domains. In mathematics, the harmonized gap widens gradually over 2015–2025, reaching its highest value in 2025.

## Annex A. Mathematics: supplementary tables

This annex gives the four-cycle series, the national items of 2025, the decile profile, the system-level results and the correlates of the mismatch for mathematics, the domain reported in the main text.

**Table A.1.** Level of the Q4 − Q1 gap by index and cycle, 2015–2025, published and harmonized (four-cycle) indices, mathematics, simple average of 34 OECD systems present in all four cycles. Harmonized indices use the 13 common possessions items; PARED is on a common scale, with 2015 rebuilt from HISCED using the 2018 mapping (Section 2.4). The sample excludes Colombia and Lithuania.

| Index | Version | 2015 | 2018 | 2022 | 2025 | Δ 22–25 | Δ 15–25 |
|---|---|---|---|---|---|---|---|
| **ESCS** | **Published** | **82.8** | **86.8** | **93.9** | **82.8** | **−11.1** | **+0.1** |
| | **Harmonized** | **81.2** | **83.8** | **86.4** | **87.7** | **+1.3** | **+6.5** |
| HOMEPOS | Published | 69.3 | 73.4 | 90.2 | 54.8 | −35.4 | −14.5 |
| | Harmonized | 59.6 | 62.3 | 69.4 | 66.2 | −3.2 | +6.6 |
| HISEI | Common metric | 72.5 | 74.3 | 75.6 | 74.1 | −1.5 | +1.6 |
| PARED | Common metric | 49.0 | 49.5 | 45.1 | 58.5 | +13.4 | +9.5 |

**Table A.2.** The national items of 2025: share answering "yes", number of OECD systems that administered each item, and within-system correlation with achievement in each domain. Shares are weighted; correlations are simple averages over systems administering each item. Garbage collection and vacuum cleaner were not administered in any OECD system.

| Item | % "yes" | Systems | r (science) | r (mathematics) | r (reading) |
|---|---|---|---|---|---|
| Electric lighting | 99.4 | 1 | +0.08 | +0.07 | +0.08 |
| Table for meals | 96.0 | 1 | +0.08 | +0.09 | +0.06 |
| Stove or burner | 94.9 | 2 | +0.16 | +0.12 | +0.17 |
| Plumbed water | 94.4 | 2 | +0.12 | +0.12 | +0.13 |
| Air conditioning or heating | 89.6 | 11 | +0.13 | +0.13 | +0.13 |
| Refrigerator | 88.6 | 4 | +0.09 | +0.09 | +0.09 |
| Smart TV | 86.5 | 8 | −0.04 | −0.03 | −0.03 |
| Quiet place to study | 86.3 | 21 | +0.08 | +0.09 | +0.09 |
| TV or streaming subscription | 85.7 | 25 | +0.03 | +0.03 | +0.05 |
| Sewer connection | 84.8 | 2 | +0.24 | +0.23 | +0.25 |
| Off-street parking | 79.2 | 4 | +0.15 | +0.16 | +0.14 |
| Dishwasher | 75.5 | 15 | +0.10 | +0.12 | +0.09 |
| Own tablet | 50.1 | 14 | −0.08 | −0.07 | −0.07 |
| Security system | 46.5 | 26 | −0.04 | −0.01 | −0.05 |
| Guest room | 36.5 | 22 | −0.04 | −0.01 | −0.06 |
| Newspaper subscription | 30.8 | 8 | +0.08 | +0.08 | +0.07 |
| Swimming pool or jacuzzi | 26.9 | 18 | −0.07 | −0.05 | −0.09 |
| Domestic workers | 19.0 | 22 | −0.08 | −0.05 | −0.10 |
| Garbage collection | – | 0 | – | – | – |
| Vacuum cleaner | – | 0 | – | – | – |

**Table A.3.** Change 2022–2025 in mean mathematics score by equal-weight decile of ESCS, published versus harmonized, simple average of 36 OECD systems (Figure 2). Deciles are recomputed within system, cycle and BRR replicate. Standard errors (s.e.) combine sampling and imputation variance.

| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D10 − D1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ESCS, published | −0.7 | −4.9 | −2.8 | −4.7 | −3.6 | −1.9 | −3.0 | −2.8 | −10.3 | −23.4 | −22.8 |
| (s.e.) | 1.1 | 1.1 | 1.2 | 1.2 | 1.3 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 | 1.7 |
| ESCS, harmonized | −6.9 | −9.0 | −6.1 | −6.2 | −4.2 | −4.3 | −4.0 | −2.7 | −6.5 | −7.9 | −1.1 |
| (s.e.) | 1.1 | 1.1 | 1.1 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.4 | 1.4 | 1.7 |

**Table A.4.** Change 2022–2025 in the Q4 − Q1 gap by system and index, mathematics. Score points; equal-weight quartiles within system and cycle; systems ordered by the published ESCS gap change. HISEI, PARED and books use common metrics. The last two columns give ESCS standard errors (s.e.). Significant narrowing at 5%: 19 systems for the published index and 1 for the harmonized index; significant widening: 1 and 2, respectively.

| System | ESCS pub. | ESCS harm. | HISEI | PARED | HOMEPOS pub. | HOMEPOS harm. | Books | s.e. pub. | s.e. harm. |
|---|---|---|---|---|---|---|---|---|---|
| Israel | −41.5 | −20.3 | −16.2 | −4.6 | −65.4 | −18.2 | −13.6 | 7.7 | 7.2 |
| Lithuania | −26.0 | −10.6 | −8.6 | +2.2 | −43.1 | −7.1 | −17.6 | 6.1 | 6.3 |
| Austria | −25.1 | −10.5 | −13.0 | −8.1 | −39.9 | −7.9 | −9.2 | 5.4 | 5.7 |
| Slovenia | −24.8 | −1.8 | −9.4 | +8.8 | −50.4 | +3.4 | −3.2 | 5.9 | 5.9 |
| Belgium | −19.7 | −7.6 | −7.5 | +9.2 | −36.7 | −6.7 | −3.5 | 6.7 | 6.4 |
| Switzerland | −19.2 | −3.7 | −0.3 | +21.8 | −61.0 | −20.5 | −7.4 | 6.3 | 6.6 |
| Sweden | −19.2 | −3.7 | +8.4 | +22.2 | −54.9 | −18.9 | −1.7 | 5.9 | 6.0 |
| Australia | −18.4 | −3.0 | −5.0 | +4.0 | −44.3 | −8.9 | −8.6 | 5.0 | 4.8 |
| France | −18.0 | −4.5 | −8.8 | +11.7 | −39.8 | −4.7 | −13.1 | 6.7 | 6.7 |
| Hungary | −17.2 | −7.6 | −21.3 | +15.7 | −37.3 | −5.5 | −13.4 | 8.5 | 8.3 |
| Slovakia | −17.0 | +0.1 | −18.9 | +30.5 | −51.5 | −14.2 | −9.9 | 8.9 | 8.8 |
| Latvia | −16.4 | −8.8 | −13.5 | +10.7 | −28.4 | −2.3 | +1.8 | 5.1 | 5.3 |
| Czechia | −16.2 | −0.6 | −11.5 | +3.9 | −43.5 | +5.0 | +0.5 | 6.7 | 7.0 |
| Denmark | −16.1 | +1.0 | −10.0 | +17.5 | −25.4 | −2.5 | −3.3 | 6.1 | 5.8 |
| New Zealand | −16.0 | −2.0 | −4.4 | −8.8 | −23.7 | −0.8 | −5.3 | 6.7 | 6.9 |
| Poland | −15.0 | −1.5 | −7.5 | +6.7 | −41.4 | −6.4 | −2.8 | 6.9 | 6.8 |
| Iceland | −14.0 | +2.4 | −1.9 | −6.3 | −19.9 | +9.2 | +12.9 | 6.6 | 6.7 |
| Spain | −13.7 | −0.0 | −2.3 | +12.7 | −37.9 | −5.2 | −9.3 | 4.0 | 4.0 |
| Canada | −13.6 | −0.4 | −1.2 | +12.2 | −34.6 | +2.0 | −3.0 | 4.5 | 4.6 |
| Finland | −12.3 | +4.1 | −5.8 | +14.9 | −44.8 | −9.5 | −8.3 | 4.7 | 4.4 |
| United States | −9.0 | +4.2 | +3.0 | +5.9 | −27.7 | −0.7 | −6.3 | 18.6 | 19.5 |
| Korea | −7.1 | +6.0 | +15.2 | +18.7 | −25.3 | +1.4 | −6.7 | 9.8 | 9.1 |
| Italy | −6.1 | +5.3 | −3.4 | +11.4 | −19.2 | +8.1 | +10.2 | 7.6 | 7.2 |
| Estonia | −5.3 | +6.0 | +7.2 | +6.0 | −35.4 | −2.5 | −3.6 | 6.2 | 6.1 |
| Netherlands | −4.3 | −0.0 | −2.1 | +29.7 | −46.1 | −33.8 | −9.6 | 8.7 | 8.7 |
| Norway | −2.5 | +11.0 | +22.3 | +29.7 | −35.4 | −4.0 | −5.9 | 5.8 | 5.9 |
| Japan | −2.0 | +15.1 | +7.7 | +12.1 | −40.2 | −0.2 | +14.1 | 9.6 | 9.7 |
| Mexico | −1.3 | +2.6 | +3.8 | +4.0 | −19.9 | −3.5 | +7.3 | 6.0 | 6.0 |
| Ireland | −1.2 | +4.5 | +6.2 | +13.4 | −19.6 | +1.8 | +1.8 | 5.3 | 5.2 |
| Portugal | −1.2 | +5.1 | +5.6 | +13.9 | −20.6 | −4.9 | −6.3 | 6.8 | 6.5 |
| Colombia | −0.5 | +6.0 | +1.2 | +20.3 | −11.9 | −0.7 | −3.9 | 9.2 | 9.8 |
| Germany | +0.2 | +12.1 | +3.0 | +32.3 | −24.6 | +7.3 | +4.1 | 6.9 | 6.6 |
| United Kingdom | +0.3 | +10.6 | +6.0 | +25.2 | −30.8 | +3.4 | +4.1 | 8.2 | 8.2 |
| Chile | +0.6 | +8.5 | +10.4 | +17.7 | −20.1 | +0.0 | −4.3 | 6.4 | 6.5 |
| Greece | +1.1 | +13.5 | +6.4 | +17.7 | −29.2 | +3.5 | +13.5 | 6.8 | 6.8 |
| Türkiye | +14.0 | +24.4 | +9.7 | +41.7 | −29.9 | +2.2 | −0.8 | 7.1 | 7.1 |

**Table A.5.** Change 2022–2025 in the mean mathematics score of the bottom (Q1) and top (Q4) quartiles by system, published versus harmonized ESCS and HOMEPOS. Values are score points; systems are ordered by the published ESCS gap change (Table A.4).

| | ESCS | | | | HOMEPOS | | | |
|---|---|---|---|---|---|---|---|---|
| System | Q1 pub. | Q1 harm. | Q4 pub. | Q4 harm. | Q1 pub. | Q1 harm. | Q4 pub. | Q4 harm. |
| Israel | +3.0 | −2.5 | −38.5 | −22.8 | +10.2 | −14.3 | −55.2 | −32.5 |
| Lithuania | +8.3 | +2.9 | −17.7 | −7.7 | +18.1 | −1.0 | −24.9 | −8.2 |
| Austria | +2.6 | −4.4 | −22.4 | −14.9 | +10.7 | −4.4 | −29.2 | −12.3 |
| Slovenia | −11.6 | −17.1 | −36.4 | −18.9 | −1.6 | −25.9 | −52.0 | −22.4 |
| Belgium | +4.7 | +1.9 | −15.0 | −5.7 | +8.3 | −2.1 | −28.4 | −8.8 |
| Switzerland | +2.2 | −1.3 | −17.0 | −5.0 | +17.2 | −1.0 | −43.8 | −21.5 |
| Sweden | −10.5 | −16.0 | −29.6 | −19.8 | +9.0 | −7.1 | −45.9 | −26.0 |
| Australia | −2.4 | −7.8 | −20.8 | −10.9 | +10.2 | −5.9 | −34.1 | −14.8 |
| France | −2.3 | −9.1 | −20.3 | −13.6 | +3.8 | −11.4 | −36.0 | −16.1 |
| Hungary | −4.0 | −9.7 | −21.3 | −17.3 | +7.4 | −9.6 | −29.8 | −15.1 |
| Slovakia | +19.4 | +7.0 | +2.4 | +7.2 | +34.0 | +16.3 | −17.5 | +2.0 |
| Latvia | −8.9 | −12.1 | −25.3 | −20.9 | −9.8 | −21.9 | −38.2 | −24.2 |
| Czechia | +2.7 | −5.9 | −13.5 | −6.6 | +13.5 | −11.5 | −30.0 | −6.4 |
| Denmark | −7.6 | −11.2 | −23.7 | −10.2 | −7.8 | −16.8 | −33.2 | −19.3 |
| New Zealand | +15.7 | +10.4 | −0.4 | +8.5 | +15.6 | +6.6 | −8.1 | +5.8 |
| Poland | +3.7 | −4.6 | −11.3 | −6.1 | +16.9 | +3.0 | −24.4 | −3.4 |
| Iceland | +5.8 | +0.8 | −8.2 | +3.2 | −3.5 | −13.9 | −23.4 | −4.7 |
| Spain | −10.5 | −15.2 | −24.2 | −15.2 | +2.8 | −12.3 | −35.2 | −17.4 |
| Canada | −6.3 | −9.6 | −19.9 | −9.9 | +0.7 | −13.3 | −33.9 | −11.3 |
| Finland | −8.4 | −15.3 | −20.7 | −11.3 | +9.4 | −7.0 | −35.4 | −16.4 |
| United States | +3.8 | −3.1 | −5.2 | +1.1 | +5.3 | −2.1 | −22.4 | −2.9 |
| Korea | −5.3 | −14.1 | −12.4 | −8.1 | +9.1 | −5.7 | −16.2 | −4.4 |
| Italy | +0.9 | −6.3 | −5.2 | −1.0 | +3.7 | −10.4 | −15.5 | −2.4 |
| Estonia | −4.0 | −8.4 | −9.3 | −2.4 | +16.5 | −1.0 | −18.9 | −3.5 |
| Netherlands | −7.3 | −4.8 | −11.5 | −4.8 | +10.0 | +17.2 | −36.1 | −16.6 |
| Norway | −18.5 | −22.8 | −20.9 | −11.8 | +0.6 | −13.2 | −34.8 | −17.2 |
| Japan | −8.1 | −15.0 | −10.1 | +0.1 | +5.7 | −8.2 | −34.5 | −8.5 |
| Mexico | −6.5 | −8.6 | −7.8 | −6.1 | +2.2 | −6.5 | −17.8 | −10.0 |
| Ireland | −10.5 | −13.4 | −11.7 | −8.8 | −3.8 | −14.1 | −23.4 | −12.3 |
| Portugal | −11.1 | −12.5 | −12.3 | −7.4 | −1.9 | −8.1 | −22.6 | −13.0 |
| Colombia | −1.2 | −3.0 | −1.7 | +3.0 | +3.1 | −3.1 | −8.8 | −3.8 |
| Germany | −11.1 | −14.5 | −10.9 | −2.5 | +2.2 | −12.0 | −22.4 | −4.7 |
| United Kingdom | −6.0 | −6.8 | −5.7 | +3.9 | +10.9 | −5.3 | −19.9 | −1.9 |
| Chile | −6.2 | −10.7 | −5.6 | −2.1 | +2.3 | −5.4 | −17.8 | −5.4 |
| Greece | −9.3 | −13.3 | −8.2 | +0.2 | +6.7 | −8.7 | −22.5 | −5.2 |
| Türkiye | +4.3 | −1.5 | +18.3 | +22.9 | +21.6 | +6.5 | −8.3 | +8.7 |

**Table A.6.** Correlation across the 36 OECD systems of the mismatch between the published and the harmonized change in the Q4 − Q1 gap with system characteristics, by domain. Mismatch is the published minus harmonized gap change; negative values indicate more narrowing under the published index. Mean ESCS, mean score and GDP per capita (PPP dollars) refer to 2022. With 36 systems, the 5% critical absolute correlation is 0.33.

| Correlation across 36 OECD systems | Science | Mathematics | Reading |
|---|---|---|---|
| Mismatch (published − harmonized gap change) with mean ESCS 2022 | −0.58 | −0.46 | −0.51 |
| Mismatch with mean score 2022 | −0.37 | −0.37 | −0.26 |
| Mismatch with log GDP per capita (PPP, 2022) | −0.40 | −0.26 | −0.31 |
| Published gap change with mean ESCS 2022 | −0.55 | −0.50 | −0.32 |
| Harmonized gap change with mean ESCS 2022 | −0.33 | −0.39 | −0.13 |
| Harmonized gap change with log GDP per capita | −0.12 | −0.13 | +0.07 |

## Annex B. Science

This annex replicates the mathematics results of Sections 3.1 to 3.6 for science: the change by quartile and decile, the four-cycle series, the correlations between components, the fixed-threshold groups, the item validation and the system-level results. Same samples, weights and procedures as in the main text.

**Table B.1.** Change 2022–2025 in mean science score by equal-weight quartile and in the Q4 − Q1 gap, by index, simple average of 36 OECD systems. s.e.: standard error of the change in the Q4 − Q1 gap, combining the sampling variance from the 80 BRR replicates and the imputation variance across the ten plausible values. Quartiles are recomputed within system, cycle and BRR replicate. HISEI, PARED and books use the common metrics of Section 2.4.

| Index | Version | Q1 | Q2 | Q3 | Q4 | Q4 − Q1 | (s.e.) |
|---|---|---|---|---|---|---|---|
| **ESCS** | **Published** | **+5.0** | **+3.5** | **+4.7** | **−7.7** | **−12.7** | **1.25** |
| | **Harmonized** | **−0.6** | **+2.0** | **+2.9** | **+1.5** | **+2.0** | **1.27** |
| HOMEPOS | Published | +15.7 | +5.9 | −6.6 | −23.2 | −38.9 | 1.20 |
| | Harmonized | +0.1 | −1.7 | −2.6 | −3.6 | −3.7 | 1.20 |
| HISEI | Common metric | +2.2 | +4.0 | +4.6 | +1.4 | −0.9 | 1.18 |
| PARED | Common metric | −4.0 | +0.3 | +7.5 | +9.7 | +13.7 | 1.01 |
| Books at home | Common metric | −0.6 | −2.3 | −2.1 | −3.1 | −2.6 | 1.23 |

**Table B.2.** Change 2022–2025 in mean science score by equal-weight decile of ESCS, published versus harmonized, simple average of 36 OECD systems. Deciles are recomputed within system, cycle and BRR replicate. Standard errors (s.e.) combine sampling and imputation variance.

| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D10 − D1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ESCS, published | +6.8 | +2.8 | +5.4 | +2.6 | +3.7 | +5.6 | +4.1 | +4.2 | −3.7 | −17.8 | −24.6 |
| (s.e.) | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.3 | 1.4 | 1.3 | 1.8 |
| ESCS, harmonized | −0.2 | −1.9 | +1.4 | +1.0 | +3.1 | +2.8 | +2.3 | +5.2 | +1.3 | −0.7 | −0.4 |
| (s.e.) | 1.2 | 1.2 | 1.1 | 1.4 | 1.3 | 1.2 | 1.3 | 1.3 | 1.4 | 1.3 | 1.8 |

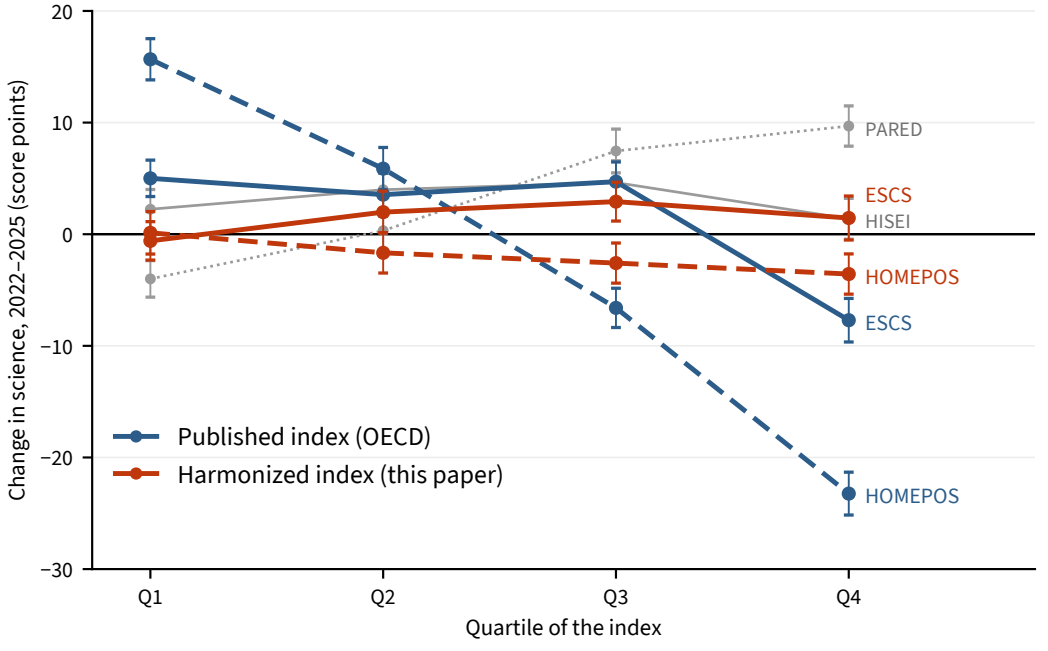


**Figure B.1. Science: the fan of the published HOMEPOS disappears once item parameters are fixed.** Change between 2022 and 2025 in the mean science score of each quartile of the index. Colour identifies the version: blue denotes the published index (OECD) and orange the harmonized index (this paper). Solid lines show ESCS and dashed lines HOMEPOS. The harmonized HOMEPOS is a graded response model calibrated once on both cycles with the 16 common items, whereas the published index changed items between cycles; the harmonized ESCS combines the three harmonized components with the OECD's rule for the composite. Grey lines show parental occupation (HISEI, solid) and parental education (PARED, dotted) on their harmonized metric, which have no published counterpart. Quartiles hold 25% of the student weight each and are computed within each system and cycle; values are simple averages of 36 OECD systems. Vertical error bars show 95% confidence intervals for each quartile's change in mean score. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

**Table B.3.** Level of the Q4 − Q1 gap by index and cycle, 2015–2025, published and harmonized (four-cycle) indices, science, simple average of 34 OECD systems. Harmonized indices use the 13 common possessions items; PARED is on a common scale, with 2015 rebuilt from HISCED using the 2018 mapping (Section 2.4). The sample excludes Colombia and Lithuania.

| Index | Version | 2015 | 2018 | 2022 | 2025 | Δ 22–25 | Δ 15–25 |
|---|---|---|---|---|---|---|---|
| **ESCS** | **Published** | **86.9** | **86.1** | **96.6** | **83.8** | **−12.8** | **−3.1** |
| | **Harmonized** | **84.6** | **82.5** | **88.5** | **90.0** | **+1.5** | **+5.4** |
| HOMEPOS | Published | 72.5 | 71.7 | 93.6 | 54.1 | −39.6 | −18.5 |
| | Harmonized | 60.7 | 59.4 | 71.9 | 68.4 | −3.5 | +7.7 |
| HISEI | Common metric | 77.0 | 74.5 | 77.4 | 76.4 | −1.1 | −0.6 |
| PARED | Common metric | 50.6 | 48.8 | 46.2 | 60.0 | +13.8 | +9.3 |

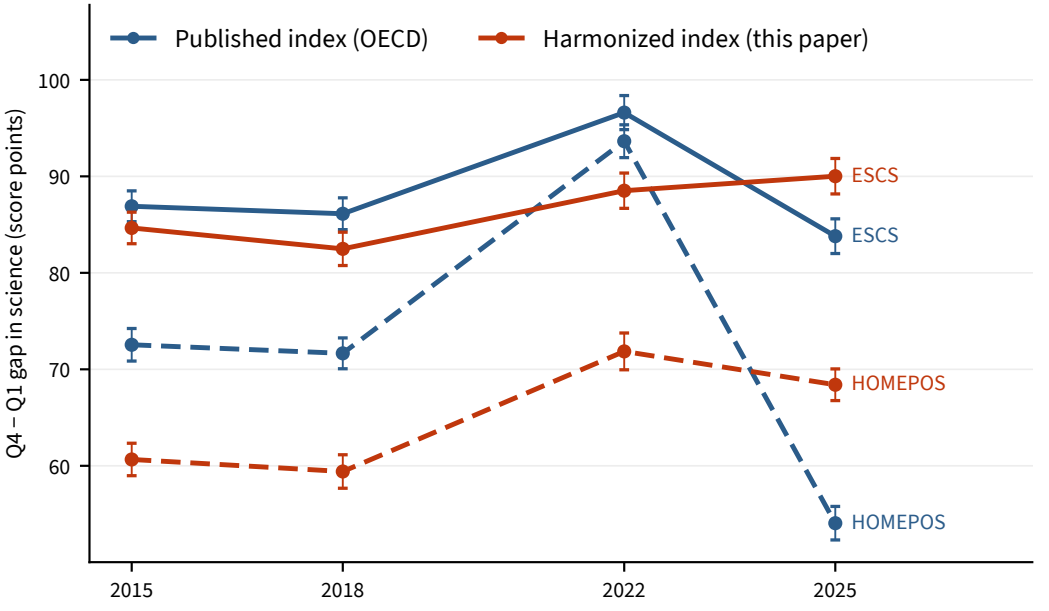


**Figure B.2. Level of the socioeconomic gap in science, 2015–2025: published versus harmonized indices.** Difference in mean science score between the top and bottom quartiles (Q4 − Q1) of ESCS (solid lines) and of HOMEPOS (dashed lines). Orange denotes the harmonized four-cycle index (this paper), which uses the 13 possessions items whose concept exists in every cycle with one calibration for the four cycles, parental education mapped to a common scale, and the OECD's rule for the composite; blue denotes the index as published by the OECD. Quartiles hold 25% of the student weight each and are computed within each system and cycle; values are simple averages of the 34 OECD systems present in all four cycles. Vertical error bars show 95% confidence intervals for each estimated Q4 − Q1 gap. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

**Table B.4.** Within-system correlations between the components of ESCS and with achievement, published and harmonized versions, science, average of 36 OECD systems. Achievement is the mean of the ten plausible values. Published indices are the OECD versions; harmonized indices follow Section 2.4.

| | Pub. 2022 | Pub. 2025 | Harm. 2022 | Harm. 2025 |
|---|---|---|---|---|
| HISEI – PARED | 0.441 | 0.479 | 0.451 | 0.479 |
| HISEI – HOMEPOS | 0.399 | 0.339 | 0.366 | 0.352 |
| PARED – HOMEPOS | 0.333 | 0.322 | 0.311 | 0.330 |
| HISEI – achievement | 0.324 | 0.323 | 0.324 | 0.323 |
| PARED – achievement | 0.229 | 0.291 | 0.231 | 0.291 |
| HOMEPOS – achievement | 0.379 | 0.212 | 0.289 | 0.267 |

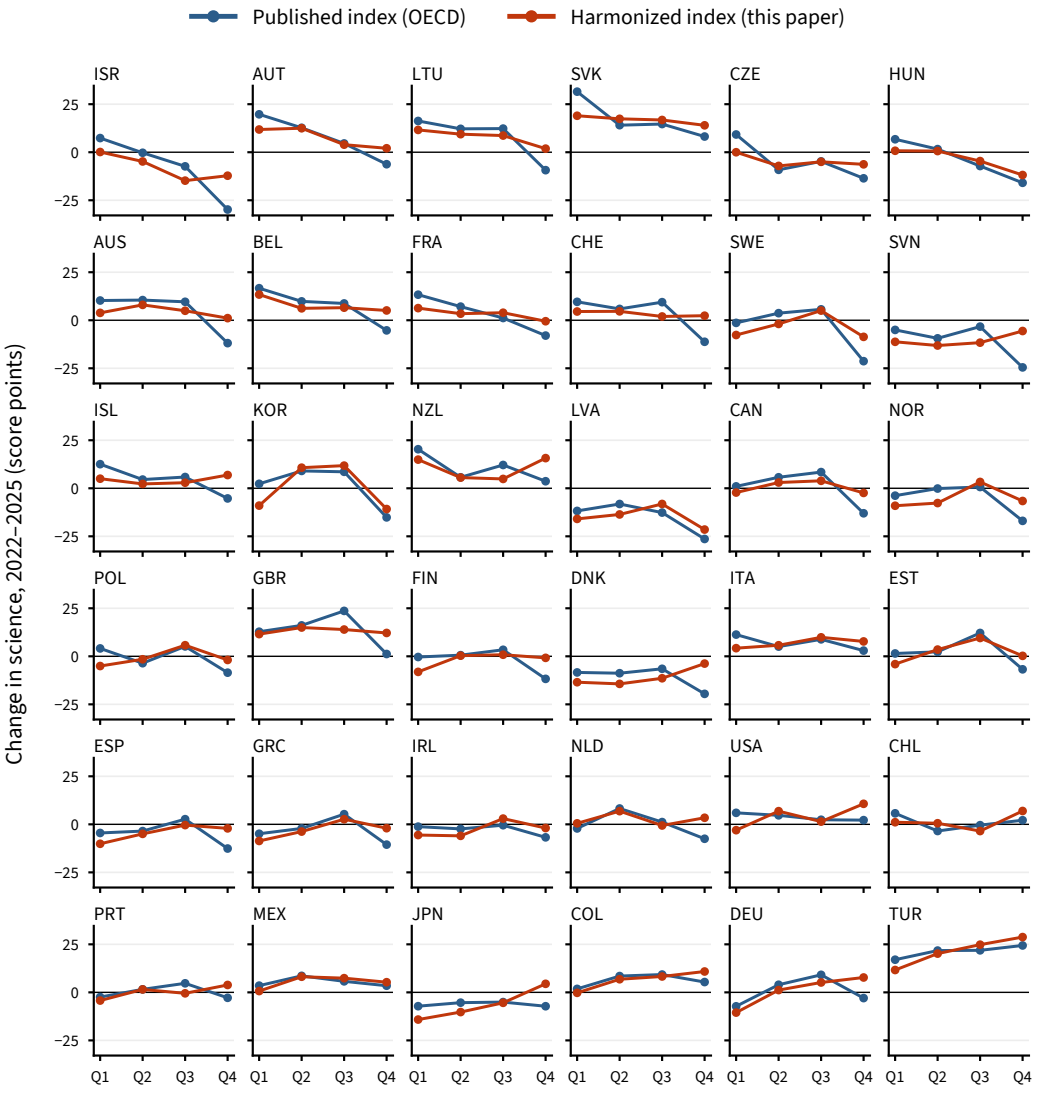


**Figure B.3. Change 2022–2025 in mean science score by ESCS quartile, by system.** Each panel is one education system, identified by its three-letter code; panels are ordered by the change in the Q4 − Q1 gap under the published ESCS, from the largest narrowing (top left) to the largest widening (bottom right). Orange lines show harmonized ESCS (this paper), which rescales the household possessions component on the 16 items present in both cycles with a single joint calibration and follows the OECD's rule for the composite; blue lines show ESCS as published by the OECD. Points are the change in the mean score of each equal-weight quartile, computed within system and cycle; the axes are shared across panels. Standard errors of the change in the gap by system are given in Table B.7.

**Table B.5.** Mean score of groups defined by fixed thresholds in both cycles, science, simple average of 36 OECD systems; share of students in each group. Shares are calculated among students with a valid value of the grouping variable. Mean scores are accompanied by BRR standard errors (s.e.).

| Fixed group (same threshold in both cycles) | % 2022 | % 2025 | 2022 | 2025 | Change | (s.e.) |
|---|---|---|---|---|---|---|
| Parents with tertiary education (16 years) | 55.1 | 51.6 | 507 | 516 | +9.3 | 0.78 |
| Parents with 12 years or fewer | 33.6 | 38.7 | 462 | 462 | −0.4 | 0.72 |
| HISEI 60 or above | 45.4 | 48.2 | 521 | 523 | +1.4 | 0.75 |
| HISEI below 35 | 30.0 | 27.0 | 453 | 454 | +1.1 | 0.75 |
| More than 100 books | 34.2 | 33.5 | 528 | 525 | −2.6 | 0.84 |
| 25 books or fewer | 36.5 | 37.7 | 441 | 441 | +0.3 | 0.80 |

**Table B.6.** Within-system correlations of possessions items with science achievement, parental occupation (HISEI) and parental education (PARED), by item group, averaged across 36 OECD systems. Partial r is the correlation with achievement net of HISEI and PARED. The country-specific 2022 items ST250D06 and ST250D07 are excluded.

| Item group | r score | r HISEI | r PARED | partial r |
|---|---|---|---|---|
| Dropped in 2025 (11 items, measured in 2022) | 0.198 | 0.180 | 0.155 | 0.148 |
| Common to both cycles (16 items), 2022 | 0.116 | 0.150 | 0.128 | 0.068 |
| Common to both cycles (16 items), 2025 | 0.102 | 0.143 | 0.132 | 0.051 |
| New in 2025, national selection (18 items with data) | 0.045 | 0.092 | 0.089 | 0.009 |

**Table B.7.** Change 2022–2025 in the Q4 − Q1 gap by system and index, science. Score points; equal-weight quartiles within system and cycle; systems ordered by the published ESCS gap change. HISEI, PARED and books use common metrics. The last two columns give ESCS standard errors (s.e.). Significant narrowing at 5%: 18 systems for the published index and 0 for the harmonized index; significant widening: 0 and 3, respectively.

| System | ESCS pub. | ESCS harm. | HISEI | PARED | HOMEPOS pub. | HOMEPOS harm. | Books | s.e. pub. | s.e. harm. |
|---|---|---|---|---|---|---|---|---|---|
| Israel | −37.2 | −12.3 | −15.0 | −0.2 | −55.3 | −4.9 | +1.0 | 7.5 | 7.6 |
| Austria | −26.0 | −9.8 | −9.4 | −2.9 | −53.2 | −17.4 | −8.9 | 6.4 | 6.4 |
| Lithuania | −25.6 | −9.7 | −5.4 | −0.2 | −43.2 | −4.9 | −18.0 | 6.2 | 6.4 |
| Slovakia | −23.4 | −5.0 | −20.4 | +28.8 | −58.1 | −19.4 | −14.0 | 9.0 | 8.6 |
| Czechia | −22.8 | −6.3 | −13.6 | +5.4 | −56.0 | −3.6 | −6.1 | 7.6 | 7.8 |
| Hungary | −22.7 | −12.6 | −21.5 | +6.6 | −39.6 | −5.5 | −9.6 | 8.4 | 8.1 |
| Australia | −22.2 | −2.7 | −6.3 | +2.5 | −52.0 | −8.0 | −11.0 | 5.8 | 5.6 |
| Belgium | −21.9 | −8.3 | −7.5 | +7.1 | −42.6 | −9.8 | −4.6 | 6.9 | 6.6 |
| France | −21.3 | −6.8 | −7.5 | +6.8 | −46.1 | −6.6 | −12.1 | 7.4 | 7.3 |
| Switzerland | −20.8 | −2.2 | +0.6 | +21.9 | −63.4 | −14.1 | −5.4 | 6.6 | 6.9 |
| Sweden | −19.9 | −1.0 | +11.4 | +20.8 | −60.8 | −15.8 | −3.8 | 7.1 | 7.5 |
| Slovenia | −19.5 | +5.6 | +4.5 | +13.5 | −53.1 | +6.6 | +1.2 | 6.0 | 6.1 |
| Iceland | −17.8 | +1.9 | −4.9 | −3.8 | −29.7 | +7.4 | +12.4 | 7.4 | 7.4 |
| Korea | −17.5 | −1.8 | +10.4 | +10.4 | −38.9 | −10.5 | −14.7 | 9.0 | 8.8 |
| New Zealand | −16.7 | +0.8 | −4.3 | −2.3 | −30.2 | −1.1 | +0.0 | 6.6 | 6.5 |
| Latvia | −14.6 | −5.5 | −11.3 | +11.9 | −26.1 | +5.5 | +6.0 | 5.9 | 5.9 |
| Canada | −14.0 | −0.2 | −2.8 | +10.8 | −36.4 | +0.4 | −2.4 | 5.1 | 5.2 |
| Norway | −13.1 | +2.5 | +16.6 | +23.5 | −43.6 | −6.5 | −10.9 | 6.5 | 6.5 |
| Poland | −12.6 | +3.2 | −1.4 | +7.9 | −41.5 | −3.3 | +4.1 | 7.0 | 7.0 |
| United Kingdom | −11.6 | +0.6 | +1.6 | +9.9 | −40.5 | −3.0 | −3.6 | 7.8 | 8.0 |
| Finland | −11.4 | +7.3 | −4.7 | +20.9 | −55.8 | −12.6 | −2.2 | 5.7 | 5.3 |
| Denmark | −11.2 | +9.7 | +2.7 | +20.5 | −24.5 | +4.9 | +2.0 | 7.4 | 6.8 |
| Italy | −8.3 | +3.5 | −2.4 | +12.7 | −28.8 | +4.3 | +8.4 | 7.2 | 6.9 |
| Estonia | −8.2 | +4.3 | +3.3 | +12.5 | −41.5 | −7.2 | −5.3 | 6.4 | 6.1 |
| Spain | −8.1 | +8.0 | +1.8 | +18.4 | −33.0 | +3.9 | −1.9 | 4.3 | 4.3 |
| Greece | −5.7 | +6.6 | +3.1 | +16.2 | −36.9 | −3.1 | +7.6 | 7.1 | 7.4 |
| Ireland | −5.6 | +3.6 | +2.7 | +19.0 | −26.3 | +1.8 | +3.6 | 5.9 | 5.8 |
| Netherlands | −5.4 | +2.9 | −6.6 | +37.3 | −52.8 | −32.3 | −14.1 | 9.3 | 9.4 |
| United States | −3.8 | +13.7 | +10.2 | +11.5 | −26.7 | +5.4 | −2.7 | 17.9 | 18.9 |
| Chile | −3.6 | +5.8 | +7.4 | +11.2 | −19.0 | +3.7 | −10.0 | 7.3 | 7.4 |
| Portugal | −0.4 | +8.1 | +4.8 | +18.8 | −22.1 | −3.0 | −5.3 | 6.8 | 6.2 |
| Mexico | −0.0 | +4.6 | +6.7 | +6.6 | −24.8 | −7.1 | +12.4 | 6.7 | 6.9 |
| Japan | −0.0 | +18.6 | +10.0 | +10.0 | −36.8 | +4.2 | +12.4 | 9.2 | 9.2 |
| Colombia | +3.6 | +11.1 | +11.0 | +23.9 | −11.4 | +0.9 | −1.9 | 10.2 | 10.9 |
| Germany | +4.3 | +18.3 | +5.6 | +40.6 | −21.2 | +14.8 | +8.5 | 8.2 | 7.9 |
| Türkiye | +7.4 | +17.1 | −0.1 | +34.1 | −28.7 | +2.7 | −3.2 | 6.9 | 6.9 |

## Annex C. Reading

This annex replicates the mathematics results of Sections 3.1 to 3.6 for reading: the change by quartile and decile, the four-cycle series, the correlations between components, the fixed-threshold groups, the item validation and the system-level results. Same samples, weights and procedures as in the main text.

**Table C.1.** Change 2022–2025 in mean reading score by equal-weight quartile and in the Q4 − Q1 gap, by index, simple average of 36 OECD systems. s.e.: standard error of the change in the Q4 − Q1 gap, combining the sampling variance from the 80 BRR replicates and the imputation variance across the ten plausible values. Quartiles are recomputed within system, cycle and BRR replicate. HISEI, PARED and books use the common metrics of Section 2.4.

| Index | Version | Q1 | Q2 | Q3 | Q4 | Q4 − Q1 | (s.e.) |
|---|---|---|---|---|---|---|---|
| **ESCS** | **Published** | **−3.8** | **−7.5** | **−8.1** | **−20.7** | **−16.9** | **1.27** |
| | **Harmonized** | **−9.4** | **−9.2** | **−9.6** | **−11.7** | **−2.3** | **1.28** |
| HOMEPOS | Published | +5.6 | −5.8 | −18.8 | −35.5 | −41.0 | 1.27 |
| | Harmonized | −10.0 | −13.4 | −14.8 | −16.0 | −6.0 | 1.24 |
| HISEI | Common metric | −7.1 | −7.0 | −8.2 | −11.5 | −4.3 | 1.26 |
| PARED | Common metric | −13.5 | −10.8 | −5.1 | −2.8 | +10.7 | 1.06 |
| Books at home | Common metric | −10.7 | −13.2 | −14.3 | −16.3 | −5.6 | 1.24 |

**Table C.2.** Change 2022–2025 in mean reading score by equal-weight decile of ESCS, published versus harmonized, simple average of 36 OECD systems. Deciles are recomputed within system, cycle and BRR replicate. Standard errors (s.e.) combine sampling and imputation variance.

| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D10 − D1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ESCS, published | −0.9 | −5.9 | −5.2 | −8.2 | −8.0 | −6.7 | −8.4 | −9.6 | −16.8 | −30.3 | −29.4 |
| (s.e.) | 1.2 | 1.3 | 1.4 | 1.3 | 1.4 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.9 |
| ESCS, harmonized | −8.1 | −10.9 | −9.1 | −9.8 | −8.7 | −8.9 | −10.5 | −8.6 | −12.2 | −13.1 | −5.0 |
| (s.e.) | 1.3 | 1.2 | 1.2 | 1.4 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 | 1.5 | 1.9 |

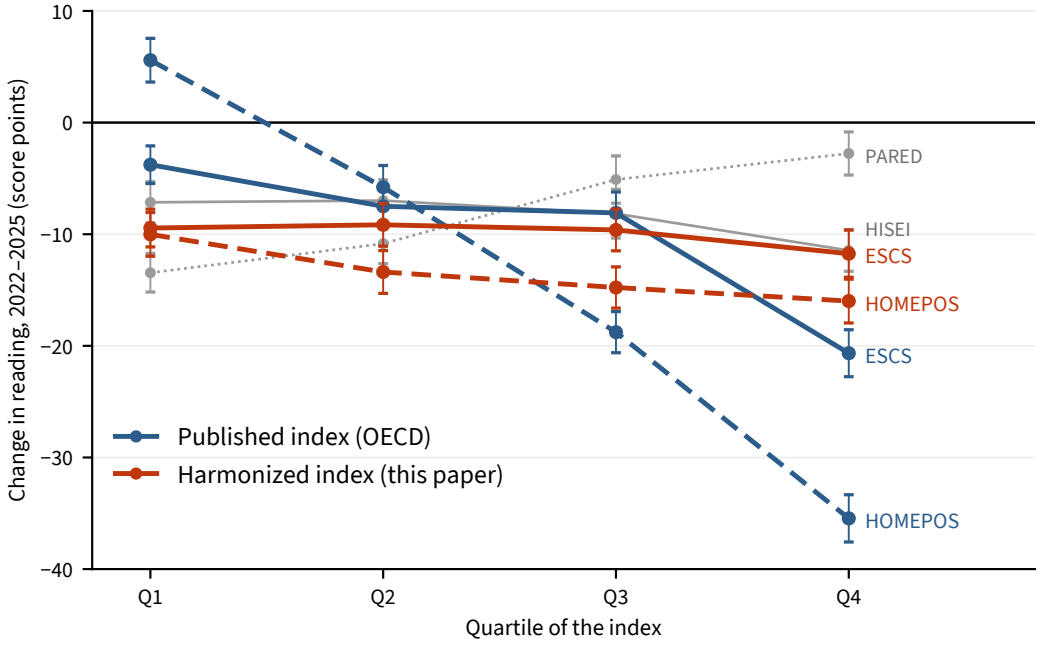


**Figure C.1. Reading: the fan of the published HOMEPOS disappears once item parameters are fixed.** Change between 2022 and 2025 in the mean reading score of each quartile of the index. Colour identifies the version: blue denotes the published index (OECD) and orange the harmonized index (this paper). Solid lines show ESCS and dashed lines HOMEPOS. The harmonized HOMEPOS is a graded response model calibrated once on both cycles with the 16 common items, whereas the published index changed items between cycles; the harmonized ESCS combines the three harmonized components with the OECD's rule for the composite. Grey lines show parental occupation (HISEI, solid) and parental education (PARED, dotted) on their harmonized metric, which have no published counterpart. Quartiles hold 25% of the student weight each and are computed within each system and cycle; values are simple averages of 36 OECD systems. Vertical error bars show 95% confidence intervals for each quartile's change in mean score. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

**Table C.3.** Level of the Q4 − Q1 gap by index and cycle, 2015–2025, published and harmonized (four-cycle) indices, reading, simple average of 34 OECD systems. Harmonized indices use the 13 common possessions items; PARED is on a common scale, with 2015 rebuilt from HISCED using the 2018 mapping (Section 2.4). The sample excludes Colombia and Lithuania.

| Index | Version | 2015 | 2018 | 2022 | 2025 | Δ 22–25 | Δ 15–25 |
|---|---|---|---|---|---|---|---|
| **ESCS** | **Published** | **84.5** | **87.5** | **93.0** | **76.3** | **−16.7** | **−8.2** |
| | **Harmonized** | **82.0** | **83.0** | **85.7** | **83.0** | **−2.8** | **+1.0** |
| HOMEPOS | Published | 72.1 | 72.7 | 88.7 | 47.6 | −41.1 | −24.5 |
| | Harmonized | 59.6 | 59.0 | 68.5 | 63.1 | −5.4 | +3.6 |
| HISEI | Common metric | 74.2 | 76.1 | 75.4 | 70.9 | −4.5 | −3.4 |
| PARED | Common metric | 48.2 | 47.8 | 43.9 | 54.9 | +11.0 | +6.7 |

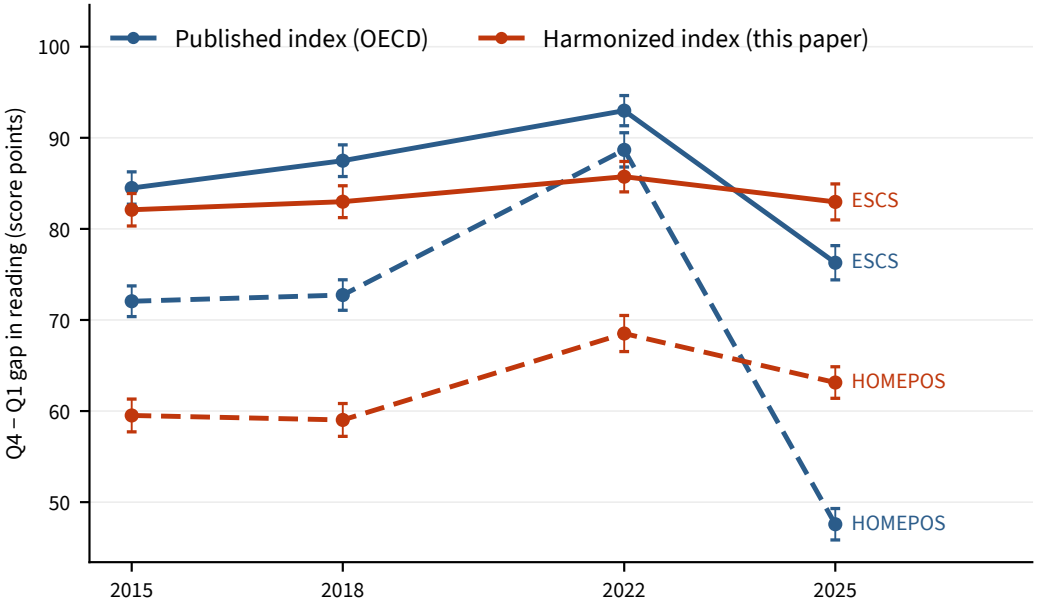


**Figure C.2. Level of the socioeconomic gap in reading, 2015–2025: published versus harmonized indices.** Difference in mean reading score between the top and bottom quartiles (Q4 − Q1) of ESCS (solid lines) and of HOMEPOS (dashed lines). Orange denotes the harmonized four-cycle index (this paper), which uses the 13 possessions items whose concept exists in every cycle with one calibration for the four cycles, parental education mapped to a common scale, and the OECD's rule for the composite; blue denotes the index as published by the OECD. Quartiles hold 25% of the student weight each and are computed within each system and cycle; values are simple averages of the 34 OECD systems present in all four cycles. Vertical error bars show 95% confidence intervals for each estimated Q4 − Q1 gap. Standard errors combine sampling variance from the 80 BRR replicates and imputation variance across the ten plausible values.

**Table C.4.** Within-system correlations between the components of ESCS and with achievement, published and harmonized versions, reading, average of 36 OECD systems. Achievement is the mean of the ten plausible values. Published indices are the OECD versions; harmonized indices follow Section 2.4.

| | Pub. 2022 | Pub. 2025 | Harm. 2022 | Harm. 2025 |
|---|---|---|---|---|
| HISEI – PARED | 0.441 | 0.479 | 0.451 | 0.479 |
| HISEI – HOMEPOS | 0.399 | 0.339 | 0.366 | 0.352 |
| PARED – HOMEPOS | 0.333 | 0.322 | 0.311 | 0.330 |
| HISEI – achievement | 0.315 | 0.302 | 0.315 | 0.302 |
| PARED – achievement | 0.218 | 0.265 | 0.219 | 0.265 |
| HOMEPOS – achievement | 0.356 | 0.186 | 0.268 | 0.240 |

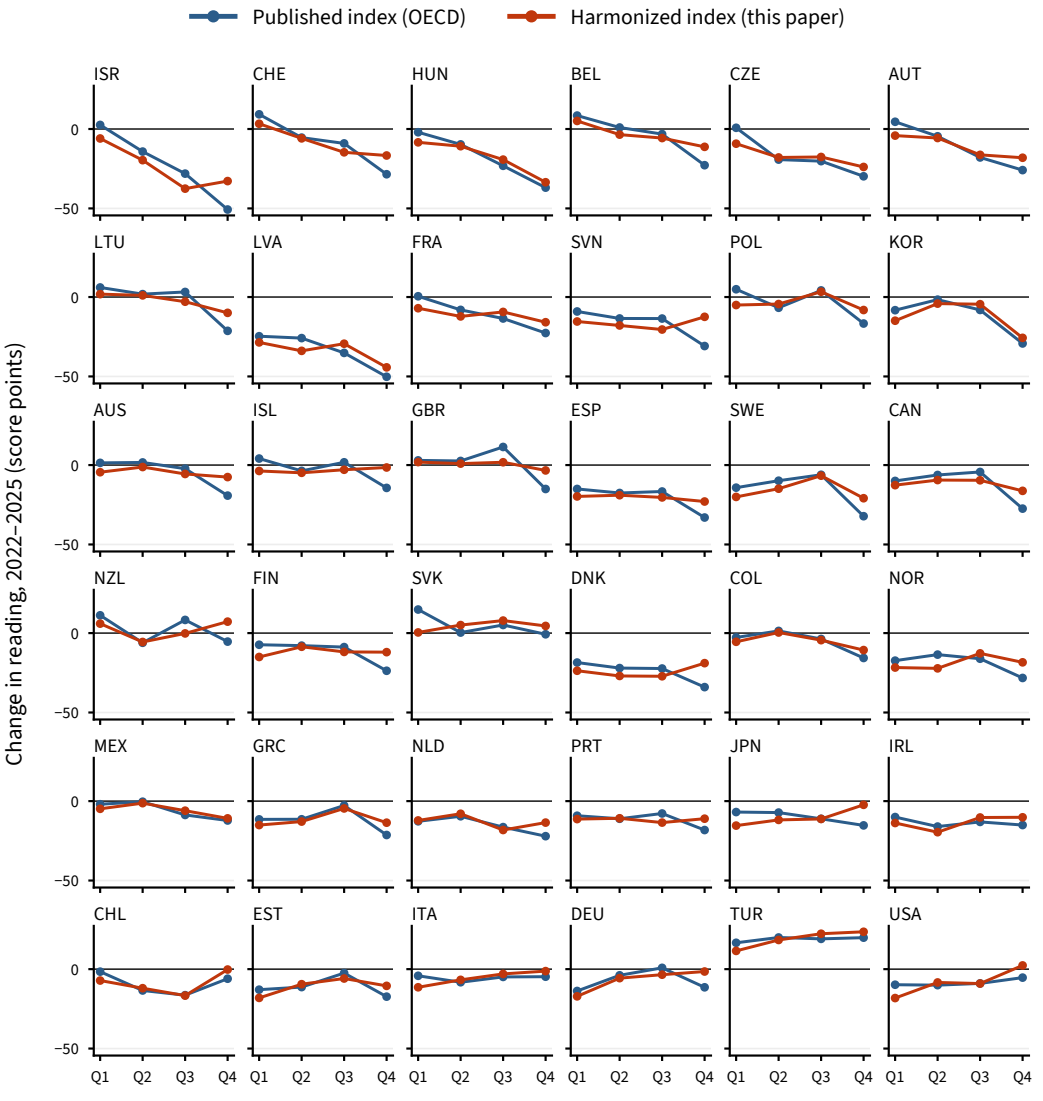


**Figure C.3. Change 2022–2025 in mean reading score by ESCS quartile, by system.** Each panel is one education system, identified by its three-letter code; panels are ordered by the change in the Q4 − Q1 gap under the published ESCS, from the largest narrowing (top left) to the largest widening (bottom right). Orange lines show harmonized ESCS (this paper), which rescales the household possessions component on the 16 items present in both cycles with a single joint calibration and follows the OECD's rule for the composite; blue lines show ESCS as published by the OECD. Points are the change in the mean score of each equal-weight quartile, computed within system and cycle; the axes are shared across panels. Standard errors of the change in the gap by system are given in Table C.7.

**Table C.5.** Mean score of groups defined by fixed thresholds in both cycles, reading, simple average of 36 OECD systems; share of students in each group. Shares are calculated among students with a valid value of the grouping variable. Mean scores are accompanied by BRR standard errors (s.e.).

| Fixed group (same threshold in both cycles) | % 2022 | % 2025 | 2022 | 2025 | Change | (s.e.) |
|---|---|---|---|---|---|---|
| Parents with tertiary education (16 years) | 55.1 | 51.6 | 497 | 494 | −3.3 | 0.86 |
| Parents with 12 years or fewer | 33.6 | 38.7 | 454 | 444 | −10.2 | 0.77 |
| HISEI 60 or above | 45.4 | 48.2 | 512 | 501 | −11.5 | 0.81 |
| HISEI below 35 | 30.0 | 27.0 | 445 | 436 | −8.4 | 0.82 |
| More than 100 books | 34.2 | 33.5 | 519 | 503 | −15.5 | 0.93 |
| 25 books or fewer | 36.5 | 37.7 | 432 | 422 | −9.5 | 0.85 |

**Table C.6.** Within-system correlations of possessions items with reading achievement, parental occupation (HISEI) and parental education (PARED), by item group, averaged across 36 OECD systems. Partial r is the correlation with achievement net of HISEI and PARED. The country-specific 2022 items ST250D06 and ST250D07 are excluded.

| Item group | r score | r HISEI | r PARED | partial r |
|---|---|---|---|---|
| Dropped in 2025 (11 items, measured in 2022) | 0.183 | 0.180 | 0.155 | 0.133 |
| Common to both cycles (16 items), 2022 | 0.108 | 0.150 | 0.128 | 0.061 |
| Common to both cycles (16 items), 2025 | 0.091 | 0.143 | 0.132 | 0.043 |
| New in 2025, national selection (18 items with data) | 0.042 | 0.092 | 0.089 | 0.009 |

**Table C.7.** Change 2022–2025 in the Q4 − Q1 gap by system and index, reading. Score points; equal-weight quartiles within system and cycle; systems ordered by the published ESCS gap change. HISEI, PARED and books use common metrics. The last two columns give ESCS standard errors (s.e.). Significant narrowing at 5%: 21 systems for the published index and 7 for the harmonized index; significant widening: 0 and 0, respectively.

| System | ESCS pub. | ESCS harm. | HISEI | PARED | HOMEPOS pub. | HOMEPOS harm. | Books | s.e. pub. | s.e. harm. |
|---|---|---|---|---|---|---|---|---|---|
| Israel | −53.3 | −26.8 | −29.0 | −9.8 | −65.3 | −11.8 | −8.7 | 8.4 | 7.9 |
| Switzerland | −37.7 | −20.0 | −12.3 | +4.9 | −72.3 | −24.2 | −13.9 | 7.0 | 7.2 |
| Hungary | −34.9 | −25.1 | −35.7 | +5.3 | −53.3 | −18.1 | −24.6 | 8.5 | 8.3 |
| Belgium | −31.3 | −16.3 | −16.4 | +1.6 | −49.6 | −15.6 | −7.5 | 7.4 | 7.1 |
| Czechia | −30.5 | −14.7 | −22.9 | −7.4 | −50.4 | +3.7 | −10.3 | 7.3 | 7.3 |
| Austria | −30.4 | −13.9 | −11.1 | −8.8 | −51.1 | −14.9 | −13.6 | 6.5 | 6.7 |
| Lithuania | −27.3 | −11.8 | −2.9 | +0.3 | −48.5 | −7.3 | −15.7 | 6.8 | 7.0 |
| Latvia | −25.5 | −15.7 | −22.4 | +5.8 | −38.8 | −3.9 | +2.6 | 5.8 | 5.8 |
| France | −23.2 | −8.8 | −9.1 | +13.0 | −50.6 | −9.7 | −20.5 | 7.8 | 7.9 |
| Slovenia | −21.8 | +2.9 | +3.0 | +3.2 | −45.5 | +5.9 | +2.4 | 6.5 | 6.9 |
| Poland | −21.6 | −3.1 | −6.5 | +6.9 | −51.0 | −7.1 | +4.6 | 8.0 | 7.7 |
| Korea | −20.9 | −10.8 | +12.9 | +9.0 | −48.4 | −20.5 | −20.8 | 8.3 | 8.0 |
| Australia | −20.6 | −3.1 | −10.7 | +2.1 | −45.6 | −2.7 | −6.1 | 5.3 | 4.9 |
| Iceland | −18.5 | +2.2 | −6.3 | +4.1 | −31.6 | +5.5 | +8.4 | 7.4 | 7.5 |
| United Kingdom | −18.0 | −5.2 | −3.8 | +14.7 | −45.9 | −11.7 | −13.3 | 7.7 | 7.9 |
| Spain | −18.0 | −3.2 | −6.4 | +6.8 | −37.5 | −4.9 | −10.9 | 4.7 | 4.8 |
| Sweden | −18.0 | −0.8 | +9.9 | +26.4 | −58.8 | −14.1 | +0.1 | 7.3 | 7.7 |
| Canada | −17.4 | −3.6 | −2.7 | +11.4 | −40.0 | −5.2 | −9.0 | 5.4 | 5.5 |
| New Zealand | −16.6 | +1.3 | −10.9 | +2.8 | −19.4 | +10.1 | +1.8 | 7.1 | 6.9 |
| Finland | −16.4 | +3.0 | −5.6 | +14.5 | −54.0 | −12.6 | −4.3 | 5.8 | 5.6 |
| Slovakia | −15.6 | +4.1 | −13.1 | +35.3 | −57.2 | −16.7 | −11.2 | 8.5 | 8.3 |
| Denmark | −15.5 | +4.8 | −1.5 | +12.3 | −28.4 | +0.1 | −8.7 | 7.4 | 6.9 |
| Colombia | −12.9 | −5.2 | −0.2 | +8.9 | −31.7 | −18.7 | −16.0 | 10.2 | 10.6 |
| Norway | −10.9 | +3.3 | +11.3 | +20.5 | −39.5 | −6.5 | −9.0 | 7.3 | 7.0 |
| Mexico | −10.2 | −6.0 | −1.6 | −1.4 | −32.2 | −16.0 | +5.3 | 7.5 | 7.8 |
| Greece | −9.8 | +1.5 | +3.6 | +11.1 | −38.0 | −5.7 | +0.1 | 7.4 | 7.7 |
| Netherlands | −9.4 | −1.4 | −7.4 | +30.7 | −53.7 | −37.1 | −12.9 | 9.0 | 9.4 |
| Portugal | −9.0 | +0.3 | +1.9 | +13.1 | −27.9 | −7.3 | −7.3 | 6.9 | 6.3 |
| Japan | −8.4 | +13.1 | +5.8 | +9.0 | −48.8 | −2.6 | +8.5 | 9.2 | 9.2 |
| Ireland | −5.0 | +3.6 | +3.8 | +16.2 | −22.4 | +4.6 | +0.6 | 5.6 | 5.4 |
| Chile | −4.4 | +6.9 | +4.2 | +13.2 | −18.4 | +9.6 | −8.3 | 7.9 | 8.2 |
| Estonia | −4.4 | +7.6 | +0.3 | +15.4 | −31.2 | +2.4 | −1.8 | 6.4 | 6.2 |
| Italy | −0.6 | +10.2 | +0.5 | +15.8 | −18.1 | +12.3 | +11.8 | 7.2 | 6.8 |
| Germany | +2.3 | +15.6 | +9.6 | +36.7 | −25.1 | +10.6 | +6.2 | 8.2 | 8.0 |
| Türkiye | +3.2 | +12.0 | +0.7 | +27.7 | −33.2 | −3.8 | −6.9 | 6.5 | 6.4 |
| United States | +4.5 | +20.5 | +16.0 | +13.8 | −14.4 | +18.7 | +7.2 | 17.7 | 18.6 |

## Annex D. Robustness: construction of the harmonized composite

The harmonized composite of the main text follows the OECD rule: the equal-weighted mean of the three harmonized components, each standardized over the pooled sample, with a single missing component imputed by a within-system regression on the other two plus a random residual. Table D.1 reports the change 2022–2025 in the Q4 − Q1 gap under ten constructions of the same three components. The first five vary the treatment of missing data and the scope of the standardization: the headline rule; the mean of the components a student actually answered, with no imputation; complete cases only; imputation without the random residual; and the OECD rule with the metric re-anchored in each cycle, which mirrors what the OECD does between cycles. The last five replace the equal-weighted mean by a principal component: pooled standardization with a pooled first principal component; per-cycle standardization with a per-cycle component; pooled standardization with per-cycle components; and the 2022 or the 2025 component weights applied to both cycles. All ten lie within three score points of each other in every domain and, only the last decile is significantly negative with a -3.66 difference, against −12.7, −11.2 and −16.9 in the last three deciles under the published ESCS. These checks concern the 2022–2025 comparison; the four-cycle series of Section 3.4 uses the headline rule.

**Table D.1.** Change 2022–2025 in the Q4 − Q1 gap under ten constructions of the harmonized composite, by domain, simple average of 36 OECD systems. Score points, with BRR standard errors (s.e.). The OECD rule has used equal weights and regression imputation since 2022; earlier cycles used the first principal component. Constructions 2, 4 and 5 have the same coverage as the headline (89.7%); complete cases cover 80.3%.

| | Science | | Mathematics | | Reading | |
|---|---|---|---|---|---|---|
| Construction of the harmonized composite | Q4 − Q1 | (s.e.) | Q4 − Q1 | (s.e.) | Q4 − Q1 | (s.e.) |
| **OECD rule: equal-weighted mean, regression imputation (headline)** | **+2.05** | **1.27** | **+1.55** | **1.21** | **−2.30** | **1.28** |
| OECD rule, mean of the available components instead of imputation | +2.63 | 1.27 | +2.19 | 1.21 | −1.76 | 1.30 |
| OECD rule, complete cases only | +0.40 | 1.34 | +0.23 | 1.31 | −3.66 | 1.37 |
| OECD rule, imputation without the random residual | +2.57 | 1.30 | +2.07 | 1.23 | −1.93 | 1.30 |
| OECD rule, metric re-anchored in each cycle | +2.55 | 1.25 | +1.88 | 1.19 | −1.95 | 1.26 |
| First principal component, pooled standardization | +3.11 | 1.22 | +2.49 | 1.17 | −1.28 | 1.22 |
| Per-cycle standardization, per-cycle principal component | +2.95 | 1.22 | +2.29 | 1.17 | −1.40 | 1.21 |
| Pooled standardization, per-cycle principal component | +2.97 | 1.25 | +2.29 | 1.19 | −1.42 | 1.26 |
| 2022 principal-component weights in both cycles | +3.03 | 1.24 | +2.34 | 1.19 | −1.34 | 1.26 |
| 2025 principal-component weights in both cycles | +3.33 | 1.23 | +2.68 | 1.18 | −1.11 | 1.24 |

## Annex E. Code and reproducibility

All the results in this paper can be reproduced from the code and data at https://github.com/Innovamat-Technology/pisa_2025. The repository contains the full pipeline, written in Python, from the OECD public-use files to every table and figure, together with an extract of those files (distributed through Git LFS). The original student questionnaire files for PISA 2015, 2018, 2022 and 2025 remain available from the OECD PISA database and are subject to its terms of use; the extract is a derivative of them and cites them accordingly. The tables and figures produced by the code are committed to the repository and can be inspected without running anything. The code is released under the MIT License and the tables and figures under CC BY 4.0.

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